Forest biomass energy use and perceptions on tree planting and community woodlots in households of two rural communities in Keiskammahoek, Eastern Cape, South Africa

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DECLARATION

I, Stella Maphiri, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part, submitted it at any university for a degree.

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ABSTRACT

Access to secure energy supplies is widely acknowledged as a critical foundation for sustainable development. Rural households are highly dependent on forest resources for their livelihoods including energy needs. Fuelwood is a non-timber forest product (NTFP) that accounts for one of the main uses of forests and woodlands. Despite substantial household electrification programmes in South Africa, the use of fuelwood as a source of energy continues. This study aimed to analyze fuelwood use patterns of two rural villages situated in Keiskammahoek in the Eastern Cape Province of South Africa in order to understand the perceptions of the community members regarding communal tree planting.

The study was conducted in two rural villages, namely, Cata and Tshoxa. A total of 120 respondents from both villages were interviewed using semi-structured questionnaires to collect data on the use of fuelwood and evaluate their perception on tree planting. The study revealed that up to 77% of the people living in Keiskammahoek used fuelwood as a major source of energy and that women were the main collectors and users of fuelwood. In the rural Cata, food is cooked in three-legged pots over open fires while in Tshoxa food is mainly cooked over paraffin and electric stoves. The respondents from both villages did not have energy conservation measures in place and improved wood stoves have not been introduced in this region. The local community of Cata was also involved in tree planting on a community level, while both villages were also involved in tree planting at a household level.

The study concluded that fuelwood was the most important product from the forests in both rural areas and natural forests were a valuable source of other NTFPs; most notably indigenous fruit products. In addition most of the fuelwood was used for cooking and heating purposes but that there was no deliberate use of energy efficient methods. On tree planting, the study showed that communities from both rural villages have an interest in planting trees around their households; with preference for fruit and shade trees.

OPSOMMING

Toegang tot betroubare energieverskaffing word algemeen erken as 'n uiters belangrike grondslag vir volhoubare ontwikkeling. Plattelandse huishoudings is hoogs afhanklik van bosbronne vir hul bestaan, met inbegrip van energiebehoeftes. Brandhout is 'n nie-hout bosproduk (NHBP) wat beskou word as een van die hoofgebruike van woude en boslande. Nieteenstaande wesenlike elektrifiseringsprogramme vir huishoudings in Suid-Afrika, duur die gebruik van brandhout as 'n bron van energie voort. Hierdie studie het beoog om die gebruikspatrone van brandhout van twee plattelandse dorpe in Keiskammahoek in die Oos-Kaapse Provinsie van Suid-Afrika te ontleed en om die begrip van die gemeenskap aangaande die gemeenskaplike plant van bome te verstaan.

Die studie is in twee plattelandse dorpe, naamlik Cata en Tshoxa, uitgevoer. Onderhoude is gevoer met 'n totaal van 120 respondente van beide dorpe deur die gebruik van halfgestruktureerde vraelyste om gegewens oor die gebruik van brandhout in te samel en die respondente se begrip van die plant van bome te evalueer. Die studie het aan die lig gebring dat tot 77% van die mense wat in Keiskammahoek woon, brandhout as 'n hoofbron van energie gebruik en dat vrouens die hoofgaarders en gebruikers van brandhout is. In die landelike Cata word kos in drie potte op oop vure gekook terwyl kos in Tshoxa hoofsaaklik op paraffien- en elektriese stowe gekook word. Die respondente van beide dorpe het nie energiebesparingsmaatreëls in plek gehad nie en verbeterde houtstowe is nog nie in hierdie streek ingebring nie. Die plaaslike gemeenskap van Cata was ook betrokke by die plant van bome op 'n gemeenskapsvlak, terwyl beide dorpe ook betrokke was by die plant van bome op 'n huishoudelike vlak.

Die studie het tot 'n gevolgtrekking gekom dat brandhout die belangrikste produk van die woude in beide plattelandse gebiede is en dat die natuurlike woude 'n belangrike bron van ander NHBP's is; veral inheemse vrugteprodukte. Daarbenewens is meeste van die brandhout gebruik vir kook- en verhittingsdoeleindes, maar daar was geen doelbewuste gebruik van energiedoeltreffende metodes nie. Op die gebied van die plant van bome het die studie getoon dat die gemeenskappe van beide plattelandse dorpe belange het in die plant van bome rondom hulle huishoudings; met voorkeur aan vrugte- en skadubome.

DEDICATION

This thesis is dedicated to my mother, Stephinah Monene Ndhlovu for her undying love, my mother-in-law, Josephine Maleshoane Maphiri who stood by me during trying times during the writing of this thesis. Dedication also goes out to all the women of Cata and Tshoxa for their support and hospitality during data collection, to my sisters and brothers. Last but not least, to my three children Refiloe, Refentse and Reitumetse for their understanding and their love that kept me going each and every day. Thanks very much.

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ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
APAN	Asia-Pacific Advanced Network
CIFOR	Centre for International Forestry Research
CPR	Common Property Resource
DME	Department of Minerals and Energy
DWAF	Department of Water Affairs and Forestry
EC	Eastern Cape
ECDC	Eastern Cape Development Corporation
FAO	Food and Agriculture Organization
GEF	Global Environmental Facility
HIV	Human Immune Virus
ICS	Improved Wood-burning Stove
ICRAF	World Agroforestry Centre
LPG	Liquid Petroleum Gas
MAP	Mean Annual Precipitation
NFTP	Non-Forest Timber Products
NGO	Non Governmental Organisation
ProBEC	Programme for Basic Energy Conservation
RWEDP	Regional Wood Energy Development Programme
SSA	Statistics South Africa

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CHAPTER ONE

INTRODUCTION

Fuelwood is a non-timber forest product (NTFP) that accounts for one of the main uses of forests and woodlands (Dovie *et al*, 2004). Access to secure energy supplies is widely acknowledged as a critical foundation for sustainable development (Shackleton *et al*, 2007b). Within this understanding, many countries, including the post-apartheid government in South Africa, undertook massive electrification programmes (Howells *et al*, 2006). This chapter introduces the use of fuelwood as a source of energy, the problems surrounding its use, the research objectives and the key research questions that are to be answered.

1.1 Problem statement and focus

Rural households are highly dependent on forest resources for their livelihoods including energy needs. Biomass energy plays a key role in meeting the energy requirements of the rural population including cooking needs of households. Fuelwood supply and demand is a crucial issue as it spans energy, environmental, health and social aspects, and is often particularly important for the poorer sectors of the community (Shackleton *et al*, 2007a). These are the issues that face the rural poor every day of their lives. To improve the environmental, health and social aspects coupled with the use of fuelwood, government has embarked on an electrification programme. According to Shackleton *et al* (2007b), South Africa produces and consumes over 60% of the electricity on the African continent and it is a twelfth highest carbon emitter in the world. However, despite the substantial household electrification, the use of fuelwood as a source of energy continues. The reason for this is that most of these households cannot afford the appliances and/or monthly costs of electricity. In addition, intensive household use of fuelwood as a 'common property resource' goes largely unregulated and poses a high risk to both trees and the people who depend on them for their livelihood (Programme for Basic Energy Conservation (ProBEC), 2007).

Of the many different traditional cooking technologies (eg., traditional clay stove, three stone traditional stoves, mud stoves, etc) existing in the rural sectors, most have been identified as “inefficient” (Bhattacharya *et al*, 1999) and air pollution from using fuelwood

unsustainably is still a familiar sight in developing countries, where women and children are the most affected (DME, 2003). Research has identified biomass smoke as a cause of acute upper and lowers respiratory infections, otitis media, chronic bronchitis/obstructive airway diseases, lung cancer, asthma, pulmonary tuberculosis, low birth weight babies, cataracts, and mouth/nasopharyngeal carcinoma (Akhtar *et al*, 2007). There is therefore a need to establish how communities use fuelwood energy to minimize on wastage and exposure to poisonous gases.

In 1990, it was estimated that over 17 million people relied on fuelwood harvested from natural woodlands in South Africa, representing over 59% of all households (Dovie *et al*, 2004). According to Statistics South Africa (SSA) (2008), the percentage of household that use either paraffin or wood for cooking declined from 37.9% in 2002 to 31.6% in 2006. This may be due to the massive electrification programmes that the government of South Africa embarked on soon after the first democratic election of 1994. However, in South Africa, Zimbabwe and Kenya affordability limited uptake (Shackleton *et al*, 2007b).

Despite the unsustainable harvesting of fuelwood, South Africa has woodlots, which, if harvested sustainably, can mitigate the 'fuelwood crisis'. The Restructuring Options for the Forest Resources of the former Homelands study has identified 93 Department of Water Affairs and Forestry (DWAF) managed woodlots or non-commercial plantations, with a total area of 12 953 ha in South Africa (LHA Management Consultants, 1998). These woodlots were initially established mainly for environmental reasons, i.e. to stop the degradation of natural woodlands which was ascribed to the harvesting of poles and firewood (Ham, 2000). However, with the current energy crisis, these woodlots can potentially supply this energy requirement for fuelwood and/or indeed bioenergy generation. It will therefore be important to establish the perception of the communities in proximity to these woodlots on their socio-economic value.

South Africa has identified the Eastern Cape and KwaZulu-Natal provinces as key for development in the forestry, wood and paper sector, with reforestation as a vital part of the strategy (South Africa.Info, 2007). With this development opportunity, forestry, if managed in a sustainable manner, could provide renewable energy to the rural communities and at the same time reducing the energy poverty in the province. This forest resource can be seen

as an opportunity for the rural communities to have access to clean energy, which is a basic need.

1.2 Objectives and key research questions

The main objective of this study were to establish the extent of use of fuelwood as a source of energy in rural households and the perception of communities on the use of existing woodlots and the new afforestation programmes of the Eastern Cape. The specific objectives were outlined as follows:

i. To evaluate the use of fuelwood energy in the rural households
ii. To evaluate the cooking habits practiced in rural households
iii. To evaluate the perception of the communities on use of community woodlots
iv. To evaluate the perception of communities on new afforestation program and community tree planting

In the light of the specific research objectives this study strived to answer the following key research questions:

i. What is the importance and use of fuelwood in rural households?
ii. What cooking habits do the rural households practice?
iii. What are the perceptions of rural communities with regard to the use of community woodlot?
iv. What are the perceptions of the community with regard to new afforestation and community tree planting?

1.3 Layout of the thesis

Chapter One presents the background, rationale and objectives of the study while Chapter Two presents the literature review that forms the first phase of this study. Chapter Three outlines the methodology used in the study including the analysis of the data collected. Chapter Four presents the results of the data collected during a field survey while Chapter Five discusses and analyses the results of the study. Chapter Six presents the conclusion from this study and also gives recommendations to sustainable and effective energy use.

CHAPTER TWO

LITERATURE REVIEW

2.1 Status of South African forestry

South Africa has extensive and valuable forest resources. In a global context, South Africa's plantations represent about 1% of the world's forestry plantations of 109.5 million ha (FAO, 2005). In their plantation statistics for 2006/2007, Forestry South Africa states that there is an estimated 1, 266, 194 million ha of plantations compared to 1, 352 million ha in 2003. This means a drop in forest area of 221 000 ha (14.9%) since 2003. Figure 2.1 shows the distribution of forest plantations in South Africa. The natural forests and woodlands benefit the communities by providing tangible and non tangible goods and services. Trees and tree products of the woodlands and forests play an important and often under-estimated role for rural communities, and are central to their lives (Timberwatch Coalition, 2000).

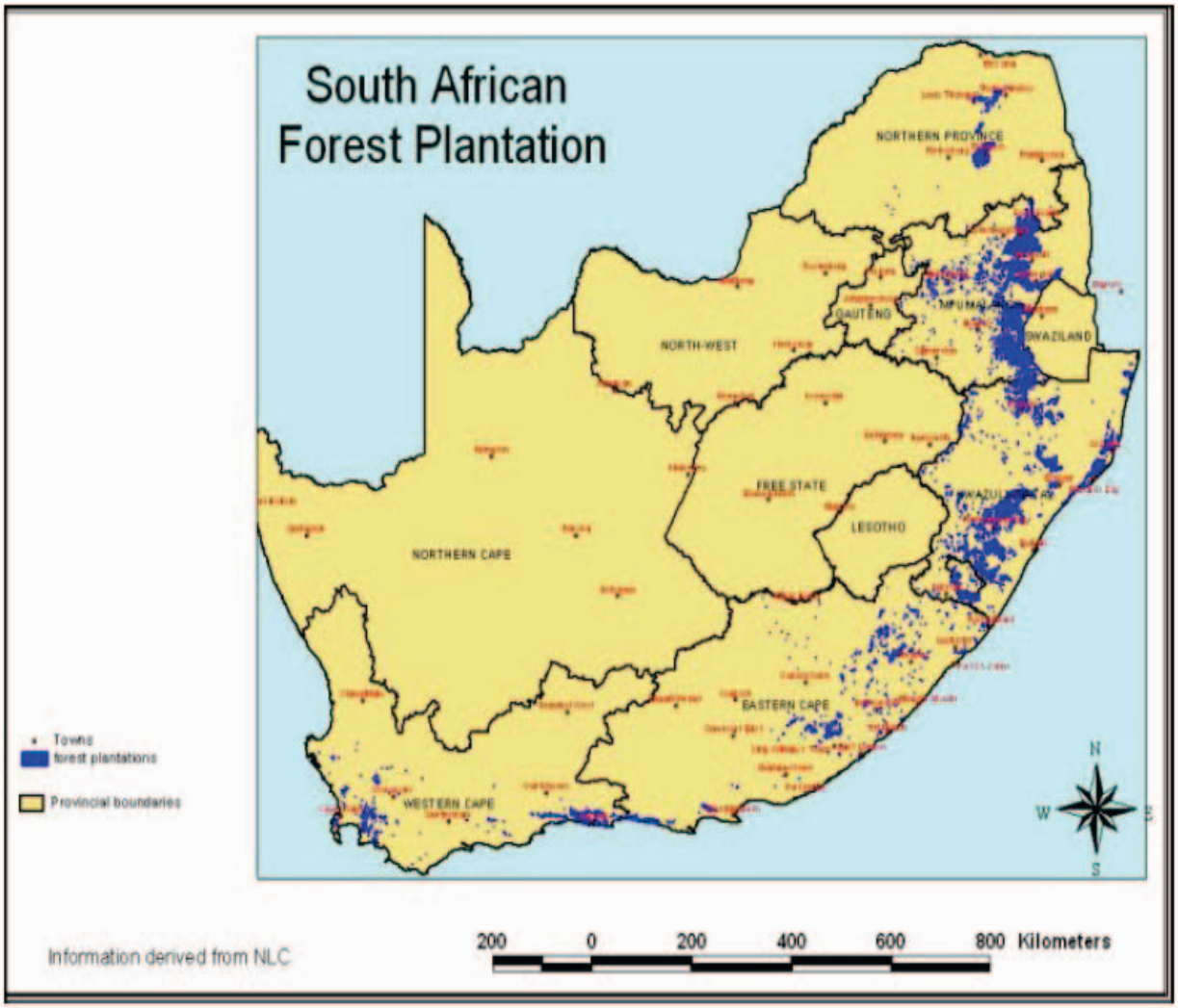

Figure 2 1 Distribution of forest plantations in South Africa (Source: DWAF, 2005)

Plantations and natural forests are recognized as playing a strategic role in addressing some of the biggest challenges in South Africa at the moment, namely poverty reduction and job creation. Increasing poverty, overutilisation, HIV/Aids and climate change have been noted as the greatest influence on the state of forests (DWAF, 2005).

2.2 Rural poverty in the Eastern Cape and the role of forestry

The forestry sector in the Eastern Cape makes a significant contribution to the rural economy and local employment. Situated in the mountainous areas of the province, mostly invisible from the major roads, the sector received little attention in the past. With a looming national timber shortage, the direneed for rural economic development, and investment in major new wood processing capacity, it is increasingly recognized that the forestry sector plays a legitimate and significant role in the local economy (DWAF, 2007).

The mid-year 2008 estimates by Statistic South Africa lists the Eastern Cape as home to about 6.58 million of South Africa's population of 48.6 million people. Measured by its total current income, the Eastern Cape is the fourth richest province in South Africa. However, in per capita income terms, the province only ranks eighth, with only Limpopo province being worse off (SSA, 2003). Though the Eastern Cape Province is rated as the poor province in South Africa, it is rich in natural resources that can be utilized in poverty alleviation programmes. Forestry and agricultural resources could play a major role in fighting the widespread poverty in which the rural areas are the worst affected.

The forestry sector has significant potential for rural development and job creation in underdeveloped areas (DWAF, 2007). This sector offers numerous benefits that are of great importance to the rural communities living in and adjacent to forests (Shackleton *et al*, 2007a). People living in and adjacent to forests are characterized by high levels of poverty, which in turn poses a developmental and environmental challenge. Forest dependent peoples are frequently amongst the most marginalized and neglected communities and as a result of this, a spectre of resource depletion always looms as people continue to use the forest resources through land transformation to farming, mining and urban uses (Shackleton *et al*, 2007 a). The sustainable management and use of these forests has a potential to mitigate these problems and also creates opportunities for both developmental and conservational goals.

2.2.1 Fuelwood use and poverty in South Africa

Nearly every aspect of development - from reducing poverty to improving health care requires reliable access to modern energy services (Baradei, 2007). This development is of special significance to Africa, where about 550 million people (75% of the population in Sub-Saharan Africa) depend on traditional biomass (wood, charcoal, cow dung, etc.) and lack access to electricity or any kind of modern energy service (Ejigu, 2008). In rural areas, energy, which is essential for development, is used to support a range of livelihoods demands. These can be broadly classified into energy services for households, community facilities and productive sector (Mulugetta et al, 2005). In industrialized countries, woodfuels have been largely replaced by more efficient and convenient sources of energy such as gas and electricity, but in total, rural households are the main users of wood energy which is used for cooking, lighting, and space heating (Semu and Mawaya, 1999).

This is however a different case in developing regions where people are not able to afford and access these fuels. Wood therefore remains a dominant form of energy. It is clear and evident that biomass fuels dominate household energy use in rural areas. This means that the rural poor have a high dependence on collected fuelwood from Common Pool Resources. The loss of access to these resources due to privatization or state control can therefore pose a significant problem. This loss of access would then result in the poorest being adversely and negatively affected. Loss of access may also result in situations where there are fuelwood shortages. With fuelwood shortages, the purchased supplies are likely to increase with some household spending more time on fuelwood collection. It is also during these shortages that the poor households would use dung and straw as sources of energy while the wealthier households will shift to alternative fuels like gas and paraffin. Hall (1992) supports this view by pointing out that when biomass is in short supply as a source of energy, this usually indicates other developmental and environmental problems. This shortage of biomass as a source of energy poses a big challenge. The challenge involves the integration of social priorities, environmental issues, financial constraints, gender differences and demographic characteristics. Once these issues are addressed and put in place, the allocation of resources will efficiently improve the quality of services delivered.

Hence, it is evident that fuelwood is the most commonly used energy source of the rural poor. Even after electrification many poor households in South Africa still use fuelwood for cooking because they cannot afford the appliances and the monthly electricity bills and the use of fuelwood for cooking is clearly correlated to poverty (Prasad and Visagie, 2005). The energy sector in South Africa has both first and third world elements (Shackleton *et al* (2007b). South Africa produces and consumes over 60% of electricity on the African continent and is the twelfth highest carbon emitter in the world, and yet over 90 % (Shackleton *et al*, 2007b) of South Africa's rural households use fuelwood for energy, as do numerous urban households.

South Africa is faced with the challenge of eradicating poverty and underdevelopment. Forestry[1] must relate directly with this larger developmental agenda. Forestry, if managed in a sustainable manner, has the potential to contribute to poverty reduction across the

[1] In terms of the National Forests Act, 1998, forests include all natural forests, woodlands and plantations as well as the forest produce produced in it. In keeping with this definition, reference to forestry development and forest activities includes the use of these three categories of forest resources, as well as the primary processing of all timber, non-timber and non-wood forest products derived from these sources.

country. This is a result not only of the fact that benefits derived from forest goods and services differ between provinces, but also that the incidence and nature of poverty vary (DWAF, 2005).

2.3 Fuelwood problems

The energy future of the biomass resource in Africa is uncertain unless fuel use patterns change (Kituyi, 2004). The high energy prices that we are experiencing currently coupled with the inevitable inability to afford conventional cooking fuel alternatives make future dependence on fuelwood to be more certain. This section first analyzes the nature and origins of fuelwood problems and later strategies or approaches to solving them.

2.3.1 Lack of access and alternative uses

The poor often have few alternatives to fuelwood to meet their basic subsistence need, and problems associated with access to fuelwood can be considered an integral part of the wider rural development crisis (Mercer and Soussan, 1992). Rural households need to have access to other alternative fuels such as Kerosene and LPG coupled with renewables such as solar photovoltaic, biogas and wind energy. Lack of alternative uses may result in an increase in demand for fuelwood, which may have devastating impact on the rural areas from which supplies are drawn (Luoga *et al*, 2000). Where there is high demand for fuelwood, people would make no attempts to conserve the resource base. Access to fuelwood resources can sometimes be limited by location of resources, land tenure and ownership of the biomass resources (Grebemedhin *et al*, 2000) . If the biomass resource lies in a private farm, households without land may face severe restrictions on access to fuels. Even the rural households who are living in and adjacent to large commercial forest face restrictions to access the biomass resources (Sankhayan and Hofstad, 2001). Even though some limited access rights may be granted to the community, illegal removal will always take place, leading to degradation of the environment. A range of traditional customs and practices on resource use does not always mean that there is regulation, since these customs often tend to break down as local economies change with increasing resource pressures (Grebemedhin *et al*, 2000).

2.3.2 Women and fuelwood hardships

Collecting fuelwood is physically hard and time-consuming work. Fifty eight years after independence, Indian women still toil daily to collect fuelwood, crop residues and animal dung – together known variously as biomass based cooking fuels, non commercial fuels or traditional fuels. This daily toiling for fuelwood does not only affect Indian women, but it is evident and happens to all women in Africa and in other developing countries (Parikh, 2005). Fuelwood and the other types of biomass used by women for cooking cause health impacts for these women and children as they emit a variety of pollutants in their close proximity (Parikh, 2005). The emission of pollutants is often in poorly ventilated kitchens. Women also have to travel for long distances in search of fuelwood. As pressures on local resource base develop, the distances traveled, collection times, and other demands on women also increase (Mercer and Soussan, 1992; Shaclekton *et al*., 2007; Chirwa *et al*., 2008). Fuelwood stress normally hits the health and environment of women harder than those of men in many parts of the Third World. Hence, women will often best understand the fuelwood problems. They also know what interventions are more likely to succeed. Unfortunately, they are not given the important role of decision making in natural resource management (Mercer and Soussan, 1992).

2.3.3 Fuelwood, deforestation, and land degradation

Land degradation is broadly defined as "…any form of deterioration of the natural potential of land that affects ecosystem integrity either in terms of reducing its sustainable ecological productivity or in terms of its biological richness and maintenance of resilience" (Global Environmental Facility, 2003). Land degradation is a result of unsustainable agricultural practices, overgrazing and deforestation. Deforestation, a major cause of forest cover loss, leads to further degradation. The over harvesting of fuelwood for energy is one of the major causes of woodland degradation. A growing urban population and an increasing demand for charcoal and fuelwood have further stressed the environment (McClintock, 2006). Mercer and Soussan (1992) seem to disagree with McClintock (2006) by stating that the rural fuelwood use is often cited as a factor in large-scale deforestation, but these ascertains are rarely substantiated. Indeed, according to the authors, the evidence points the other way around: where the forests are opened up, land clearance leads to massive fuelwood surpluses, and substantial quantities of wood resources are either burnt or left to rot.

2.4 Strategies to overcome fuelwood problems

Forest managers, resource managers, conservationists, and other players and decision makers in the forest and energy industry need to come up with sustainable solutions that will overcome fuelwood problems. Viable alternatives to reduce the number of people dependent upon fuelwood for their energy needs also need to be taken seriously.

2.4.1 Tree Planting Approaches

The most common approach by governments and donor agencies to ameliorate perceived fuelwood problems has been to plant trees (Mercer and Soussan, 1992; Ham and Theron, 2001). This was done in order to solve the energy needs of the rural communities while at the same time contributing to the economic development and maintenance of biodiversity and environmental quality. For this purpose, programmes ranging from establishment of village woodlots to large-scale fuelwood plantations were implemented. Tree planting initiatives for fuelwood can also be viewed as another way of reclaiming degraded forest lands. Planting of trees not only assists in the mitigation of fuelwood shortages, but also fulfill the rural need for the economic and non-economic benefits from trees to sustain their rural livelihood. Although the desirability of boosting tree planting on farmlands is recognized, both in the academic literature and in government policy, uptake has been lower than anticipated in many projects (Zubair and Garforth, 2005). This might be due to factors such as lack of technical knowledge by farmers, top down paternalistic approaches and wrong choice of species.

Strategies to plant trees for rural energy should be developed in consultation with the community members and the farmers. They also need to be on an understanding of farmers' tree management in the context of household livelihood strategies. Most of the time the people who are heading these tree planting projects do not have indigenous knowledge systems of local farmers and also lack knowledge about the constraints they face in developing tree resources. It is therefore important that the resource managers work hand in hand with the locals to ensure that viable solutions are implemented. Tree planting initiatives can take place through large-scale plantations, social forestry, woodlots and agroforestry (Mercer and Soussan, 1992) visa viz:

- *Large-scale plantations*: In the Sahelian zone, plantations are established mainly for fuelwood production and for providing improved environmental conditions, such as combating desertification through sand dune fixation and windbreaks (Chamshama and Nwonwu, 2004). In cases like this, exotic fast-growing species are often used.

- *Social forestry*: The term social forestry started circulating in the forestry industry since the 1980's and has many meanings. According to Westoby (1989), social forestry is defined as "tree planting and management, at the farm, village or community level, by or for small farmers and the landless". Such projects, often supported by groups like the Food and Agricultural Organization (FAO) of the United Nations, the World Bank, or the U.S. Agency for International Development, are usually aimed at the rural poor in developing areas where the major wood use is often for fuel (Klemperer, 2003).

  As part of social forestry initiative, the Biomass Initiative was launched in 1992 to address the growing fuelwood problem in rural South Africa, as part of the holistic approach to rural development (FAO, 2002). The project was meant to address the rapidly deteriorating energy situation in rural areas, the increasing poverty and halting the environmental degradation due to pressure on the land.

  Social forestry is not always easy to implement especially when there is no consultation with the local community. Lack of consultation with the local community always results in local resistance whereby the community members do not co-operate, and in this case failure would be inevitable. Beside resistance from the local community, other factors such as water and soil conditions are critical to the success of the program. Botha *et al* (2006) conducted a study on 65 outreach nursery programmes in South Africa and found that progress was hindered by biophysical problems (e.g., lack of water, poor soil conditions) as well as harsh socio-economic conditions facing most communities in which nurseries were established. These nurseries were distributed in the eight provinces.

- *Agroforestry*: The World Agrofrestry Centre (ICRAF) defines agroforestry as a collective name for land-use systems and technologies where woody perennials (trees, palms, shrubs, bamboos, etc) are used on the same land management unit as

agricultural crops and/or animals, either in some form of spatial arrangement or temporal sequence. The establishment of agroforestry systems in regions like the Eastern Cape could be one of the most important sources of fuelwood for domestic consumption in many areas in the region. FAO (2002) points out that in the tree-rich savannah veld of South Africa, such as parts of the Eastern Cape, Kwa-Zulu Natal, the Lowveld, Bushveld in the Northern Province and the Kalahari where livestock farming is practiced, trees are protected for the production of additional fodder for the drought season, as a source of fencing material and firewood, for stabilizing soil, for providing shade and for general environment conservation purposes.

Arnold and Dewees (1997) further states that other forms of tree cultivation involves the cultivation of blocks of nitrogen-fixing trees to restore agriculturally taxed soil, with side benefits of fuelwood and fodder, in the kikar (*Acacia nilotica)*-based hurries of Pakistan's Sind Province. The advancement of agroforestry practices could promote sustainable land use by incorporating wood energy development as an additional strategy in the respective agroforestry extension programmes. Where there is a need for increasing woodfuel production on farmers' land, both for initiating production and improving current production, extension is a tool to meet this goal (APAN-RWEDP, 1995). Kürsten (2000) views the existence of a fuelwood market as a basic precondition for attempts to develop sustainable land use systems that integrate trees on arable or pasture land (agroforestry). Increased production for fuelwood is driven by the acute scarcity of this form of energy and a need to reduce CO_2 emissions due to the global warming problem.

Agroforestry systems not only play a role in carbon emissions reduction and fuelwood production, but also play a very important role in soil protection and provision of additional products such as posts and materials for construction. Also with this system, there are financial benefits whereby the combination of agricultural crops with trees for fuelwood production can bring higher profits in the community. Ajayi *et al* (2007) conducted studies that show that agroforestry land use practice is more profitable than farmers' practice of continuous maize cultivation without external nutrient supplement but it is less profitable than mineral fertilizer, especially when the latter is subsidized.

- *Woodlots*: Common property resources are important sources of timber, fuelwood and grazing land in developing countries (Gebremedhin *et al*, 2000). The same applies to the Eastern Cape where the rural communities in and around the plantations depend on community woodlots for the provision of products like fuelwood, poles, fodder, fruits, etc. Ham (2000) conducted a study on the importance of woodlots in Kentani, Eastern Cape and found that DWAF personnel felt that if the woodlot belonged to the community, the community would protect it as they would have a sense of ownership. This is not always sustainable since devolving right to local community may result in exploitation of common property resource. Under unrestricted access by community members, or ineffective use regulations, these resources are exploited on a first-come, first-served basis (Gebremedhin *et al*, 2000). As a point of view, to prevent exploitation of common property resources, a balance is needed between access and needs of the community.

  The other solution may be the devolution of these natural resources to the community resource management institutions and organizations. Community resources management institutions are now receiving greater attention as a viable alternative to regulation by the state or privatization as a means of rectifying inefficiencies caused by attenuated property right systems, externalities, and other market failures (Gebremedhin *et al*, 2000).

2.4.2 Introduction of appropriate technology

In order to solve problems associated with fuelwood use, appropriate technologies could be implemented. This means that the implemented technology must meet certain criteria to be classed as being appropriate. A technology can be labeled as *appropriate* when it is simple, it responds to users' basic needs, it respects the local culture, it employs local materials and labour as much as possible, it uses resources in a rational and renewable manner, and it recognizes the technological tradition of rural people (Aguilar, 1990).

The inadequate availability of modern technologies for wood-based energy systems poses a major problem to rural communities. The present inefficient use of fuelwood is not sustainable. In most cases fuelwood is used in open fires (usually consisting of three stones

in the kitchen floor, surrounding a fire), which besides having low energy efficiency, are a source of indoor air pollution (Masera *et al*, 2000). Considering these factors, the need to develop technological solutions that address the problems of open fires is critical. In addition, the relevant Research and Development agencies should be provided with sufficient funds for making modifications in existing practices with regard to efficient collection and use of woodfuels (FAO-RWEDP, 1996).

Since the mid-1970s, a number of models of improved wood-burning cook stoves (ICS) have been developed that address the two main drawbacks of open fires, by including a combustion chamber and a tube to take the smoke outdoors (Troncoso *et al*, 2007). It is important to note that the success of such technology will depend on how the technology was introduced. If this is done without consultation or by a "top-down" approach, the project is likely to fail (Troncoso *et al*, 2007).

2.5 Gender and rural energy

Gender refers to the socially constructed roles of women and men rather than biologically-determined differences (Clancy *et al*, 2004). Gender issues are not new to wood energy development. For many years they have played a role in community forestry and household energy projects (FAO-RWEDP, 1995). It is no doubt that women are heavily involved in activities involving fuelwood collection. In most countries, at least in the rural areas, it is primarily women who are responsible for gathering firewood or crop residues for household fuel use, and subsequently also do the cooking (Skutsch, 1995). While women are the ones that are too involved in the fuelwood business, one often finds that the majority of wood energy planners are men, but when there are problems with fuelwood usage, the matter is thrown back into the women's hands. It is therefore very important that gender differences are taken into consideration when implementing fuelwood projects.

Women's involvement is not only important in the collection of fuelwood but also in its efficient utilization (Oosterveen, 1995). Women are also more concerned about the growing and management of multipurpose trees to meet the domestic requirements while men are more involved in the decision making roles regarding the growing and management of these multipurpose trees. Sometimes conflicts of priorities arise between men and women that stem from the use of different forest products. The differences between men and

women justify the need for specifically involving women in social forestry projects, not only for reasons of equity, but also because of their collection, use and distribution of fuelwood, their role in the management of fuelwood resources (although less frequently recognized) and their role in income-generating activities (Borg, 1989).

2.6 Socio-economic context of fuelwood use

In South Africa, the second smallest biome (3.3% of the land area), the Thicket Biome, is a peculiar mix of four arid and semi-arid, succulent vegetation types, concentrated, but not restricted to, the Eastern Cape Province (Pote *et al*, 2006). Socio-economically, the Eastern Cape Province has a resource that can improve livelihoods and bring about rural development and employment if the resource is managed in a sustainable manner. The unsustainable extraction of these resources raises concerns in relation to the ecological impact on biodiversity. This prompts the search for quantification of sustainable harvesting limits and the appropriate institutional arrangements under which sustainable harvesting can be implemented (Dovie *et al*, 2001). Sustainability of fuelwood production, collection and use seems to be a key issue.

The broad objective of rural energy development should aim to address the issue of rural energy, primarily woodfuels, in order to improve the socio-economic conditions of the majority of people, including the poor, the landless and women (Bhattarai, 1997). While rural development is a key component of the socio-economic well being of the community, it should be borne in mind that environmental sustainability is equally important. Fuelwood has an impact on the socio-economic issues of the rural community. It is the main energy source in rural settings for cooking and most food processing. This shows that there is a relationship between fuelwood and nutrition, meaning that fuelwood supply can influence the amount of food supplied or cooked. Cecelski (1984) reported that, in Somalia, refugees fed their bean rations to their livestock or discarded them because they could not afford the fuelwood to cook them. While this is an extreme case, it serves to illustrate the fact that whole grains and legumes are inedible without cooking.

Fuelwood does not only influence the day-to-day activities of households, but it also influences the well-being of the rural communities. It makes a significant contribution to the socio-economic welfare of the rural community associated with its production,

collection and consumption. According to FAO-RWEDP (1998), commercialization of woodfuels can lead to opportunities for integrated rural development through generation of rural employment and income. One of many reasons why rural development fails is due to the fact that planning is nit integrated (multi-sectoral). Integrated rural development leads to a holistic approach to total systems development in rural areas. Through fuelwood production projects, employment can be created for farmers and laborers and this could also lead to income generating opportunities. Income generating opportunities can also be realized through the harvesting, collection and sale of fuelwood. Although fuelwood use and production has positive impacts, there are also negative impacts that come in the form of health ailments caused by indoor air pollution resulting from fuelwood use.

2.7 Environmental impacts of fuelwood use

Biomass energy, has when seen from the environmental point of view, several advantages over conventional sources of energy (fossil fuels) but at the same time it also has some disadvantages (FAO-RWEDP, 1998). The advantage is that when biomass is being used as fuel, it does release carbon dioxide just like fossil fuels, however, when new trees are planted, for those which were used as fuel, the new trees take up more or less the same amount of carbon dioxide. This is with the result that use of biomass for energy is CO_2 neutral as compared to fossil fuels. In addition, replacing fossil fuels by biomass energy can help to reduce sulphur dioxide emissions which may cause acid rain as well as other environmentally harmful effects (FAO-RWEDP, 1998). On the other hand, if biomass is used in an unsustainable manner, it can lead to deforestation, which in turn could result in soil erosion, desertification, floods and other negative impacts linked to environmental degradation (FAO-RWEDP, 1998).

2.8 Financial constraints of fuelwood production

The rural communities face problems when it comes to issues of finances. There is lack of awareness among financial institutions/credit agencies to support tree-growing activities/programmes and lack of justification for financial resources being spent on development of wood and wood based energy systems in the public sector (FAO-RWEDP, 1996). Financial support from both private and public sector would play an important role in terms of local employment, provision of goods and services, and balanced rural

development. The financial support will also ensure efficiency and operation of the fuelwood markets for the supply of fuelwood to the rural communities (FAO-RWEDP, 1996).

2.9 Other forms of energy used in rural settings

In addition to fuelwood, rural households use paraffin, candles, batteries and reticulated electricity for other applications but frequently find these expensive (Howells *et al*, 2005). These other forms of energy are used as a choice or a substitute. Fuel choices and distribution are strongly driven by desires for greater convenience and cleanliness (Leach, 1992). Troncoso *et al* (2007) however argues that the use of other forms of energy has been slow and oriented towards complementing rather than substitute fuelwood, in what has been called "multiple fuel strategy".

2.10 Conclusions

Despite massive electrification by the government, fuelwood remains the main energy source in rural communities. Overuse and overdependence on biomass resources could threaten the biomass resources. There is therefore an need to put in place strategies to overcome fuelwood shortages. Tree planting by the communities could bring about sustainability in the collection and use of fuelwood. The next chapter presents the geography of the Eastern Cape and the role of forestry in the province. It also presents research methods that were used in gathering the data for the purposes of the study.

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1. Study area

3.1.1. Overview of the Eastern Cape Province

The Eastern Cape (EC) is situated in the South-Eastern part of South Africa. The capital city of the province is Bisho. This part of South Africa is clad with natural beauty including beautiful coastlines, temperate forests, large areas of rolling rural hinterland and semi-desert landscapes (Eastern Cape Provincial Government, 2004). The north-west part of the province borders KwaZulu-Natal and touches the southern tip of the Drankensberg range. Common in the southern parts of the province are hills and mountains within the Karoo exhibiting a flat topography.

In its mid-year population estimates, SSA (2008) estimated the population of the Eastern Cape Province to be 6.58 million of the country's total population of 48.6 million people. This then puts the Eastern Cape as home to about 13.5% of South Africa's population.

3.2 Overview of Keiskammahoek

For the purpose of this study, two communities from the Keiskammahoek area, Cata and Tshoxa, were selected. These two areas falls under the Amahlathi Municipality which falls under the greater Amatola District Municipality. Cata is situated 15 kilometers away from Keiskammahoek while Tshoxa is located approximately 2 kilometers from Keiskammahoek (see Figure 3.1). Keiskammahoek lies in a basin at the confluence of the Keiskamma and Gxulu Rivers below the Amatola. The name Keiskamma is of Khoekhoen origin, meaning either 'pufadder river' or 'glittering water' (Amahlathi District Municipality, 2008). The town is an important commercial centre for the timber and agricultural industries.

The indigenous forest of Keiskammahoek consists mainly of large and smaller fragments of afromontane forest interspersed between exotic commercial timber plantation along the southern slopes of the Amatola Mountain Range, along a west east axis, with Katberg consisting of the western, and Dontsa the eastern extreme, directly adjoining the Isidenge Forest Estate (Malgas, 2008).

Figure 3 1 Geographic locations of the two study areas in South Africa (Source: DWAF, 2005)

3.3 Physical Environments

3.3.1 Topography and climate

Extending from east to west along the main south-facing escarpment of the Amatola and Winterberg Mountain ranges, Keiskammahoek lies within these ranges, between the central interior of the former Ciskei and former Republic of South Africa. The latitude is between 32 and 33 degrees South and the longitude is between 26 and 27 degrees East.

Though it is a summer rainfall area, every month generally has some rain. The Amatola mountain areas from above Keiskammahoek to the Hogsback area experience very cold temperatures during the winter months with occasional snowfalls. The mean annual precipitation (MAP) varies from 600 mm along the coast to a low of 450 mm in parts of the dryer coastal plateau areas to over 1 200 mm on the mountain peaks (DWAF, 2004). The summer months experience rain fall with June and July months being the driest.

3.3.2 Geology and soils

The Beaufort group characterises the Amatola Mountains' geology, which can be subdivided into subgroups: Tarkastad and Adelaide, which form part of the Karoo sequence. Sediments being deposited in river channels, river floodplains, swamps and lakes formed the geology of the area (Heyns *et al* 1989).

The soil types found in the Keiskammahoek area are the deep red and yellow latosolic clays with varying amounts of rock and lithosols (Malgas, 2008). According to Heyns *et al* (1989), the area is characterized by soils with a thin, porous top layer, overlying a columnar horizon that is interspersed with red clays dominate throughout the Amatola Mountains, with the Kologha area at Stutterheim being the exception. There one will find deep red and yellow soils in an advanced stage of weathering.

3.3.3 Vegetation

The forests of Keiskammahoek are found within the Dohne Sourveld veld type 44b (Acocks, 1988). The natural vegetation in this area is mainly grasslands, savanna (thornveld or sourveld) with areas of dense bush and indigenous forests in the mountain zone. These biomes are depicted in Figure 3.2. Most forests (commercial and indigenous) are in the high rainfall areas of the Amatola. According to Malgas (2008), there are three forest types that occur in the Keiskammahoek area:

- **Moist high forest**: The moist high forests are found on the plateaus of Keiskammahoek and are characterized by canopy heights of approximately 15 to 25 metres. Trees such as Outeniqua Yellowwood (*Podocarpus falcatus*) and Lemonwood (*Xylamos monospora*) are the dominating canopy species. Other species such as Onderbos (*Trichocladus ellipticus*) dominate the ground flora. See **Appendix A** for the entire tree species found in the three forest types of Keiskammahoek area.
- **Medium moist high forest**: This forest type is characterized by canopies that range from high (20 - 25 metres) in good soil conditions to (10 - 15 metres) in drier areas. *Podocarpus latifolius* is important indicator specie for this forest.
- **Dry scrub forest**: This forest type is patchy and is characterized by low crown (6 - 10 metres). Trees are represented by species such as *Buddleia saligna* and *Schotia*

latifolia while shrubs are represented by species such as *Brachyleana glabra* and *Rhus tomentosa*.

Invasions of Black Wattle (*Acacia mearnsii*) and Black Wood (*Acacia melanoxylon*) are found throughout the area. These are the two main invasive species in Keiskammahoek forests and catchment areas. Most of the rivers are heavily infested with Black Wattle and Black Wood (Malgas, 2008) The main problem areas are in the southern foothills of the Amatola mountain range (between King William's Town, Stutterheim and Keiskammahoek) and in the former Transkei area between Butterworth and Nqamakwe. The area is also characterized by exotic weeds such as Bugweed (*Solanum Mauritianum*) in all riparian vegetation.

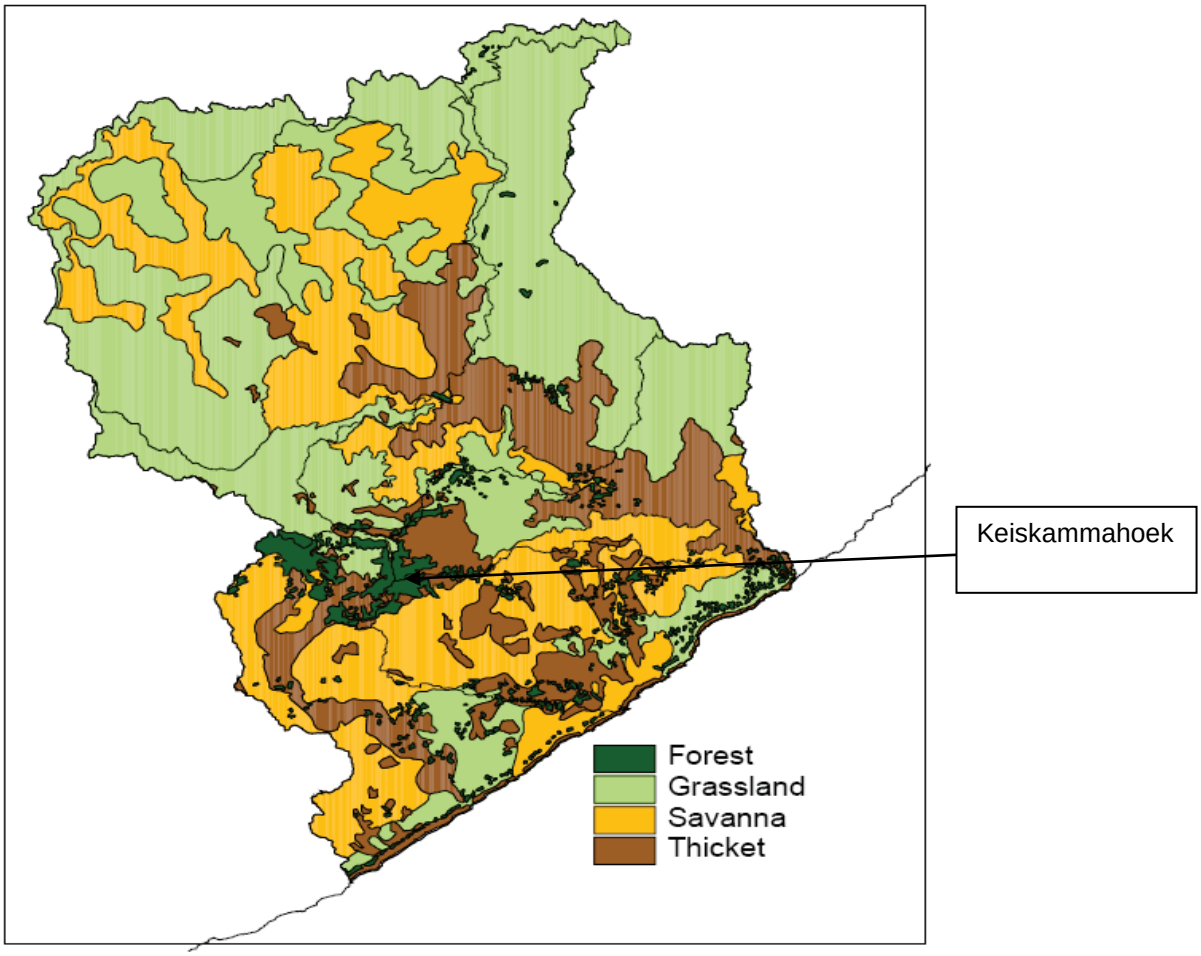

Figure 3.2 Biomes of the Keiskammahoek Area (Source: DWAF, 2004).

3.4 Cata Community

Cata is located in the former Ciskei Bantustan of the Eastern Cape Province. The Cata rural community is surrounded by forest plantation, indigenous forests and woodlots and it has also been the subject of a number of forestry/woodlot related research projects in the past. This rural village is made up of 450 households. Almost all the households in this village depend on forest products for their livelihoods. The community uses both communally owned land and non-communal forests for products such as fuelwood, building material (fence poles, house construction and planks), fruits and medicinal herbs. The condition of the indigenous forests at Cata ranges from pristine where it falls within the plantation management area to moderately utilized in the areas under community management (Chirwa *et al*, 2008a).

At the time of data collection, the village was involved in projects such as forestry, irrigation farming, and water harvesting, tourism and roads construction projects. These projects are the basis for integrated rural development and sustainable livelihood in the village. The forestry project involves the conversion of 70 ha wattle jungle into a managed plantation. In so doing, the community turns an alien invader into a useful resource. During interviews most of the community members mentioned that they attended courses on wattle management. As a result of ventures like this, the community gets empowered. A team of 22 local community members are also working to establish an approved plantation that is owned by the community. The aim of the project was to establish a 40 ha pine plantation before the end of 2007. According to BRC (2008), a total of R65 900.00 was paid to the workers during the period August to December 2006 – an important resource inflow to the community.

Local team members are also involved in agricultural activities such as irrigation farming and "Water for food". The community took advantage of the abundant water coming from the Amatola Mountains for agricultural purposes. The water is used for the irrigation of a vegetable garden that is owned by the community. To supplement this, the community is in future planning to establish a fruit orchard, produce animal fodder, use wheat to produce bread and grow groundnuts for the production of peanut-butter.

3.5 Tshoxa Community

Situated approximately 2 kilometers from Keiskammahoek, this peri-urban village is not surrounded by forests as in the case of Cata. The village, which is peri-urban, comprises of 600 households. Unlike Cata, the village does not have any developmental projects. The area is dry and characterized by shrubs, *Acacia Karoo* thorn trees and some indigenous species such as sneezewood (*Ptaeroxylon obliquum)* and yellow wood (*Podocarpus falcutus)*. Although this village is far from the plantation forest, about 15 km from Rabula plantation, it utilizes the scrub forest to harvest products such as fuelwood, honey, brushwood, sticks, thatch grass, building material and medicinal herbs. The people do however go to the main forest plantation to collect products, especially those who have access to transport. Those without access to transport buy certain products such as poles and planks from others who have access to transport. In both villages, the Department of Water Affairs and Forestry (DWAF) is working closely with the communities regarding utilization of various forest products by the communities. This ensures a well sustained and conserved resource.

3.6 Units of measurements

The wife of the household or persons acting as household heads in cases where there is no husband or wife was used as the unit of measurement. Both the head of the household and other individual members of the household participated in the survey as some questions related to all household members.

3.7 Methodology

The collection of primary data for this study involved field surveys which comprised of semi-structured interviews through the use of a questionnaire (see **Appendix B**). The use of survey design is the main element for data collection procedure in social science (Stanley and Sedlack, 1992; Bless and Higson-Smith, 2000). In conducting the survey, participatory approaches were used to collect information for this study. Permission was sought from relevant authorities in the communities before the start of the study. The two study areas, namely, Cata and Tshoxa had 450 and 600 households respectively. A sample size of 60 households was randomly selected from each study area.

3.7.1 Key informants interviews

The purpose of having key informant interviews is to collect data through the identification of members of the community who are knowledgeable about a topic and asking them questions about their experiences living within a community. Key informants should be people with above average knowledge of the issues that are of concern (The Access Project, 1999). This does not only involve community members, but also other stakeholders such as Forestry staff members and implementing agencies. The interviews should be conducted with programme staff, implementing agency, and key community members (USDJ, 2006). These community experts, with their particular indigenous knowledge and understanding, can provide insight on the nature of problems and give recommendations for solutions (Centre for Health Policy Research, 2000).

Eight local community members and three DWAF staff were selected to conduct in-depth interviews in order to obtain the general view of the research problem. The key informants included men, women and youth in the community, and DWAF's key staff in joint forest management at provincial level. Since the selected key informants had vast knowledge on issues relating to fuelwood use and collection, they were able to explain issues concerning forests and fuelwood use. The interviews were semi-structured with open-ended questions enabling respondents to speak openly for themselves without any limitations. According to Mukherjee (1993), the method allows for full participation of the respondents and generation of data for the study. Key informant interviews ensure creation of rapport within the group, and when rapport is good, the group have more strengths, and contrary to common belief, sensitive subjects are sometimes more freely discussed in groups when individuals would not to discuss them alone with a stranger (Mukherjee and Chambers, 2004).

3.8 Household surveys

Prior to data collection, an introductory meeting was held with some of the community members. The purpose was to explain what these surveys entailed and the community's role in participating in these surveys. The introductory community meetings might also be seen as a platform to discuss immediate and long-term survey objectives.

To increase reliability of the information that was collected, the questionnaire was pre-tested prior to its full application. Pre-testing is important for the questionnaire administration because the questionnaire must be clear to the respondents (Frechtling, 2002; Stanley and Sedlack, 1992). The pre-tests were done through people from the Forest and Wood Science Department (University of Stellenbosch) who come from rural areas and who are familiar with the rural lifestyle and setting. The survey method involving interviews and the questionnaire was used as it is considered the most appropriate data collection method for evaluation studies (Babbie, 2004). The household survey enabled generation of primary data from the members of the local communities through answering of the research questions using a questionnaire. The primary respondents in the household were mostly women. The questionnaire was designed for collecting data from the people involved in energy use and cooking though other members of the household contributed in responding to the questionnaire. Apart from energy use in rural areas and cooking habits, the questionnaire also included aspects such as attitudes and perceptions of local communities on community woodlots, afforestation and tree planting. The questionnaire is also an ideal technique for measuring attitudes and perception of a population (Babbie, 1999; Stanley and Sedlack, 1992).

The interviewer used open-ended questionnaires to target the persons involved in the day to day issues of energy use and cooking for the household. These persons represented each selected household. Questions were read to the respondent and the respondent's answers were recorded. The advantage of a questionnaire filled by the interviewer is that the questionnaire can be administered to respondents who are unable to read and write. The approach also helped in overcoming misunderstanding or misinterpretation of words or questions. In this case the interviewer ensures that the respondents understand the questions correctly (Stanley and Sedlack 1992; Babbie, 2002; Babbie, 2004). This approach also ensured that all items on the questionnaire were considered and no questions were omitted. Respondents were asked for explanation and clarity on certain unclear answers.

The information collected during the study included use of fuelwood energy in rural communities, household cooking habits, attitudes and perceptions of local communities on community woodlots, afforestation and tree planting.

3.9 Sampling strategy

Two rural villages in the Keiskammahoek area were selected for the purpose of this study. It was conducted in Cata and Tshoxa. Cata was selected since it has been a subject of forestry research in the past. This village has a rich history of work being done and it is also one of the villages that have seen rural development just after the land restitution process. Research work was never conducted in Tshoxa, and unlike Cata, this village is not surrounded by forests. It is however closer to the Keiskammahoek Town than Cata, situated approximately 2 kilometres from town.

A 13% sample of households was randomly selected within the Cata community while a 10% sample of households was randomly selected from the Tshoxa community. A number of 60 households were selected from each community in order to obtain accurate data on the comparison between the two communities.

3.10 Data processing and analysis

Interviews were conducted with heads of randomly selected households. The data was collected and then captured into Microsoft Excel after which it was analysed statistically using the Statistica 7.1 package. Chi-square tests were conducted to determine the relationships in the responses of the households surveyed using a 95% confidence interval.

3.11 Conclusions

This chapter outlined a background in terms of the study area investigated and the methodology used to collect the data. The Cata village is highly involved in participatory management of natural resources. Most of the respondents are women in both study areas which proves that women are always at the forefront in energy issues. Although the Tshoxa, village is not situated near plantation forests, the village utilizes the scrub forest to harvest forest products. There is therefore a link between the two villages. Irrespective of whether the village deep rural or semi-rural, fuelwood remain the source of energy. The chapter that follows presents results that were obtained through analysis of the collected data.

CHAPTER FOUR

RESULTS

This chapter presents the findings of the study including information on the use of fuelwood by the two rural communities, the cooking habits and effects on human health associated with the use of this form of energy. Another aspect presented is the attitude and perceptions of the rural communities on woodlots and community tree planting.

4. GENERAL INFORMATION

4.1 Number of people living in a household

A total of 120 households were interviewed from the two villages. One village, Cata, is surrounded by forest plantations and woodlots while Tshoxa village, which is about 2 km from town, does not have any forest plantations or woodlots surrounding it. Both communities have on average 4 individuals living in a household.

4.1.1 Number of cooking times in a day

There was a significant difference ($p = 0.0046$) between the two villages regarding the number of cooking times per day. In Cata village, 4% of the people interviewed cook food once per day, while 48% cook twice per day and the remaining 48% cooks three times per day. Tshoxa village however presents a different picture whereby 17% of the respondents cook food once per day, with 44% percent cooking twice per day, while 39% cook three times per day (see Figure 4.1).

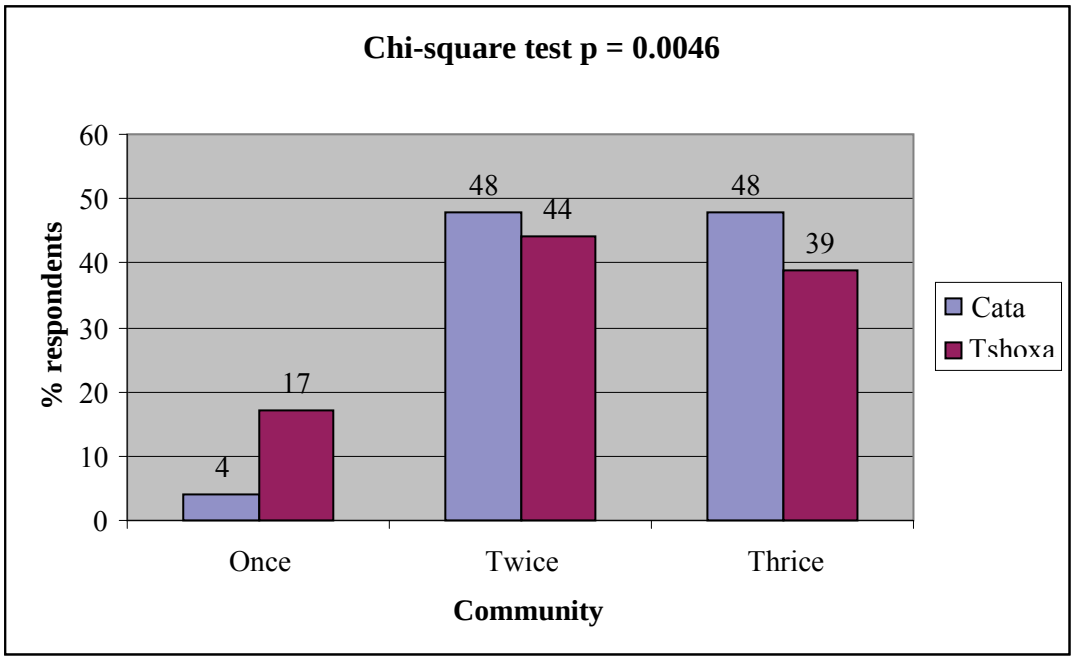

Figure 4.1 Cooking times per day

4.2 Use of fuelwood in rural households

4.2.1 Type of fuel mostly used for cooking

There was a significant difference ($p = 0.0005$) between the two rural communities regarding the type of fuel used. In Cata, 77% of the respondents use fuelwood as a source of energy for their cooking. Plate 4.1 shows fuelwood stacked outside a house in Cata. Only 5% of this village prefers using electricity while 18% of the respondents use paraffin for cooking. On the other hand, only 42% of the respondents in Tshoxa village use fuelwood for cooking. About 38% of the respondents indicated their preference for using electricity for their cooking. The other 17% of the respondents use paraffin with the remaining 3% using gas for cooking (See Figure 4.2).

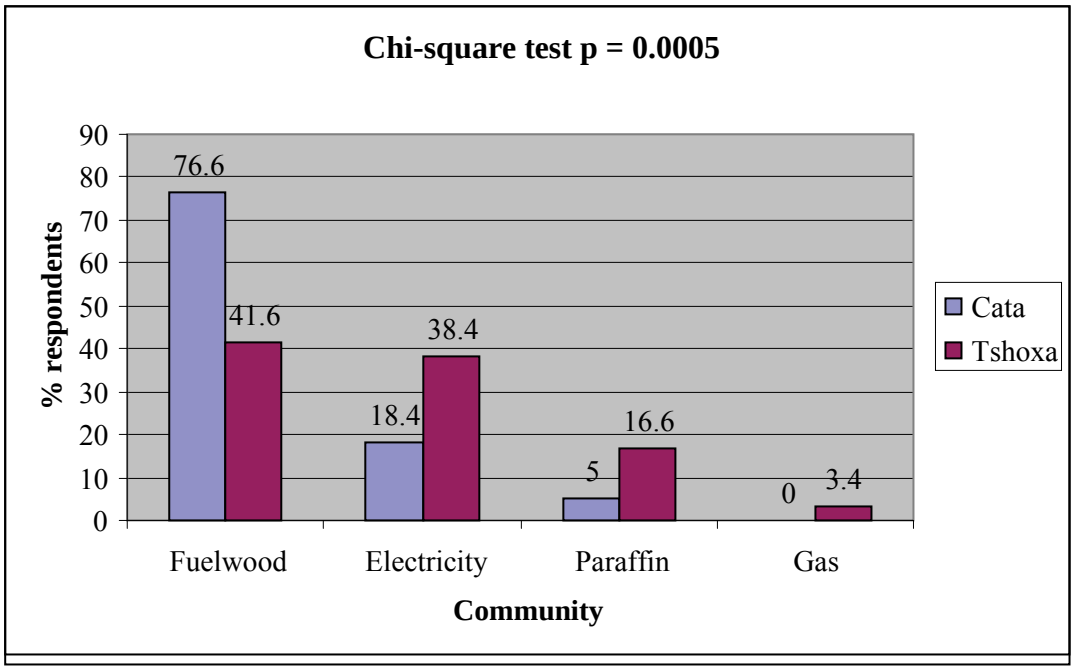

Figure 4.2 Fuels mostly used for cooking by households

Plate 4.1 A stack of fuelwood outside a house in Cata Village

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4.2.2 Fuel type used for lighting

There was no difference between the two villages regarding the types of fuel used for lighting (Figure 4.3).

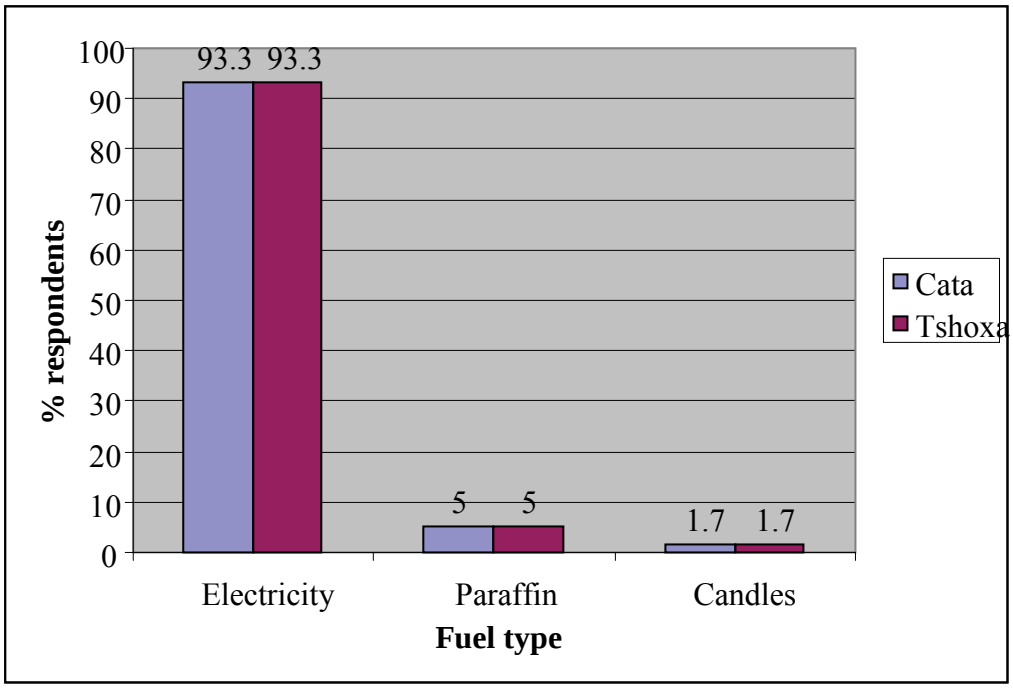

Figure 4.3 Fuels mostly used for lighting in Cata and Tshoxa villages

4.2.3 Fuel type used for heating

A large percentage of respondents (78%) in Cata use fuelwood as a source of heating or warming for their households. Only 13% and 8% of the respondents use paraffin and electricity, respectively (Figure 4.4). Although only 56% of respondents in Tshoxa use fuelwood as a source of energy for heating, there was a significant difference ($p = 0.0359$) in the use of paraffin and fuelwood as sources of energy for heating. As many as 32% of respondents in Tshoxa use electricity as opposed to only 13% of respondents in Cata.

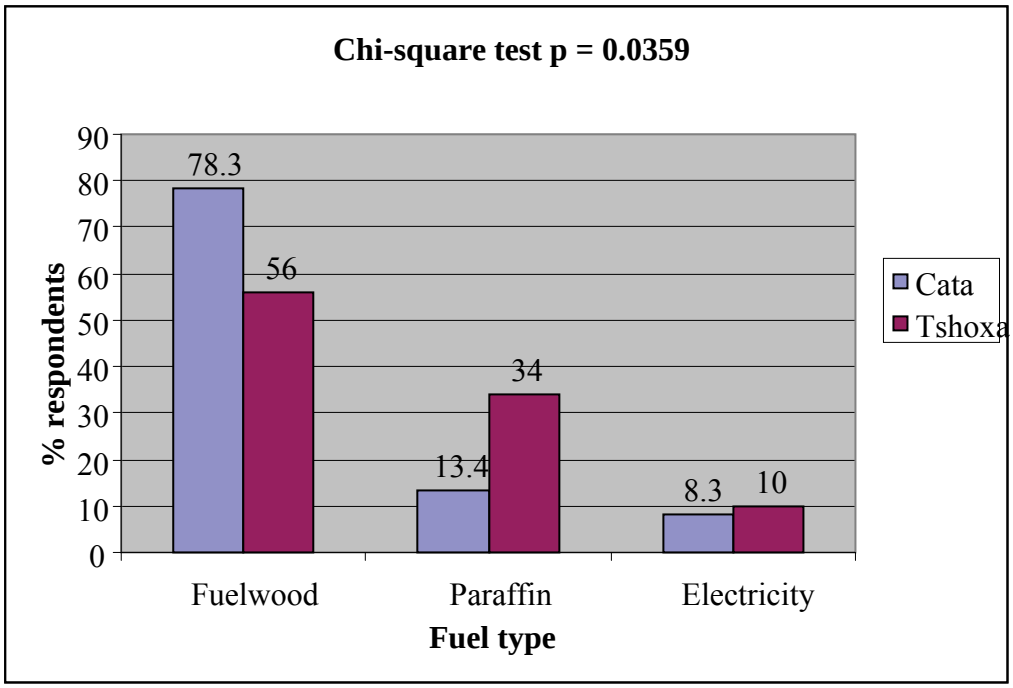

Figure 4.4 Fuels mostly used for heating in Cata and Tshoxa villages

4.2.4 Fuelwood collection and source

There was no difference between the two villages regarding the gender that mostly collected fuelwood. In both villages, women were the main collectors and users of fuelwood. Women were then followed by men and children.

The study also showed that there was no difference in the sourcing of fuelwood between the two villages with 73% of the respondents sourcing it by gathering in the forests. Most of the fuelwood is sourced through gathering while a small proportion is sourced through purchasing or purchasing combined with gathering. The community in Cata spent an average of R250 on fuelwood while the community of Tshoxa spent an average of R111 on fuelwood (Data collected during August 2008). There was no difference in how firewood was collected between the two villages with most people (75-80%) collecting their fuelwood by means of head loads bundles (see Plate 4.2). Only 7-10% of the respondents used bakkies to collect their fuelwood and 3-5% used oxen as a means to collect fuelwood. Interestingly, 13 % of the respondents in Tshoxa used wheel barrows to collect their fuelwood compared to only 2% in Cata.

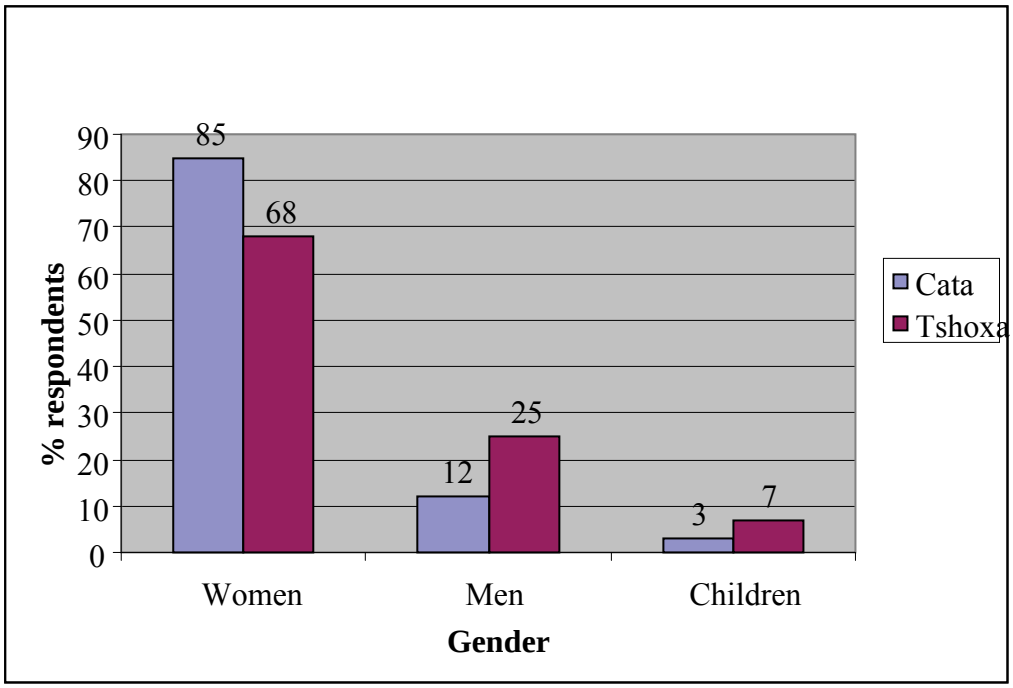

Figure 4.5 Collection of fuelwood by gender in Cata and Tshoxa villages

Plate 4.2 Fuelwood collection by means of headload

4.2.5 Harvesting methods

There were three harvesting methods confirmed by the survey including: (i) knocked out of trees (K), (ii) cut from trees and bushes (C) and (iii) picked off ground (P). There was a

significant difference ($p = 0.0000$) in the harvesting methods between the two rural villages. About 37% of the respondents in Cata indicated that they harvested their fuelwood by knocking the wood out of trees compared to 32% in Tshoxa. Additionally, only 10% of the respondents in Cata cut their wood from trees and bushes compared to 57% in Tshoxa. As many as 53% of the respondents in Cata picked their wood off ground compared to only 13% in Tshoxa (Figure 4.6)

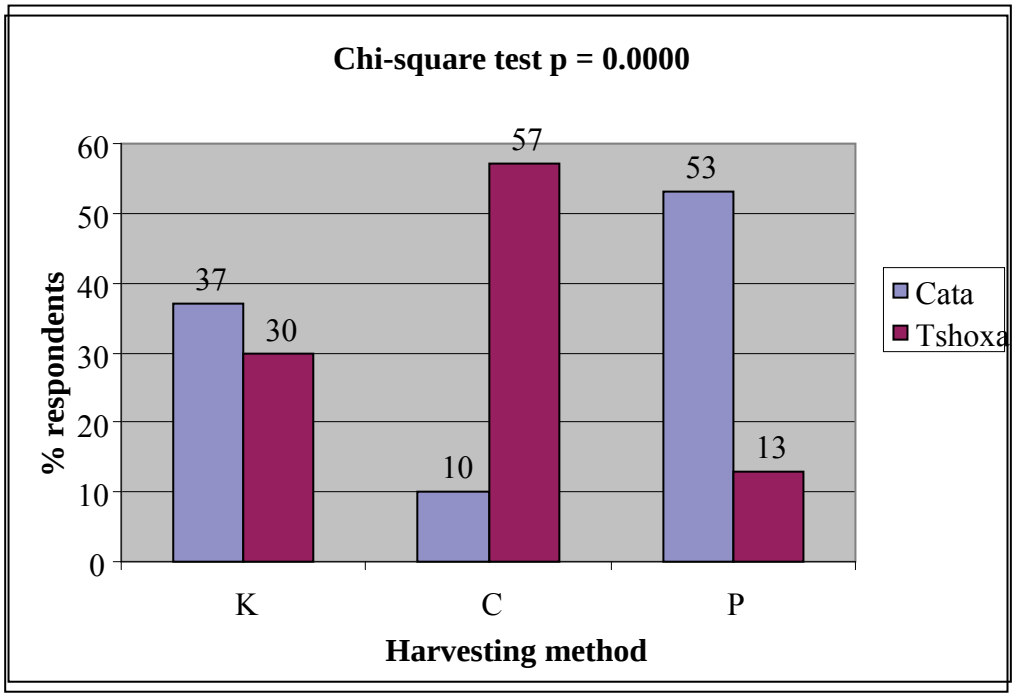

Figure 4.6 Different methods of harvesting for gathering fuelwood in the forest

4.2.6 Fuelwood scarcity and alternative energy types

There was a mixed point of views as far as the scarcity of fuelwood was concerned. Some of the respondents (50%) in Cata indicated that the fuelwood was a scarce resource while the other 50% indicated that fuelwood was not scarce at all. Unlike in Cata, more respondents in Tshoxa (58%) indicated that fuelwood was indeed a scarce resource.

There was no significant difference in the use of alternative fuels between the two rural villages. In both cases, paraffin seemed to be the alternative fuel to be used in case of fuelwood scarcity. The majority of the respondents in Tshoxa (60%) indicated that they would prefer to use paraffin in case of fuelwood scarcity compared to 48% in Cata. In Cata,

17% indicated that they would use fuelwood while in Tshoxa 8% indicated that they also use fuelwood in case paraffin or electricity were unavailable to them. The other alternative fuels were dung; 20% in Cata and 17% in Tshoxa, followed by electricity 8% in Cata and 10% in Tshoxa, and finally leaves and twigs 7% in Cata and 5% in Tshoxa (Figure 4.7).

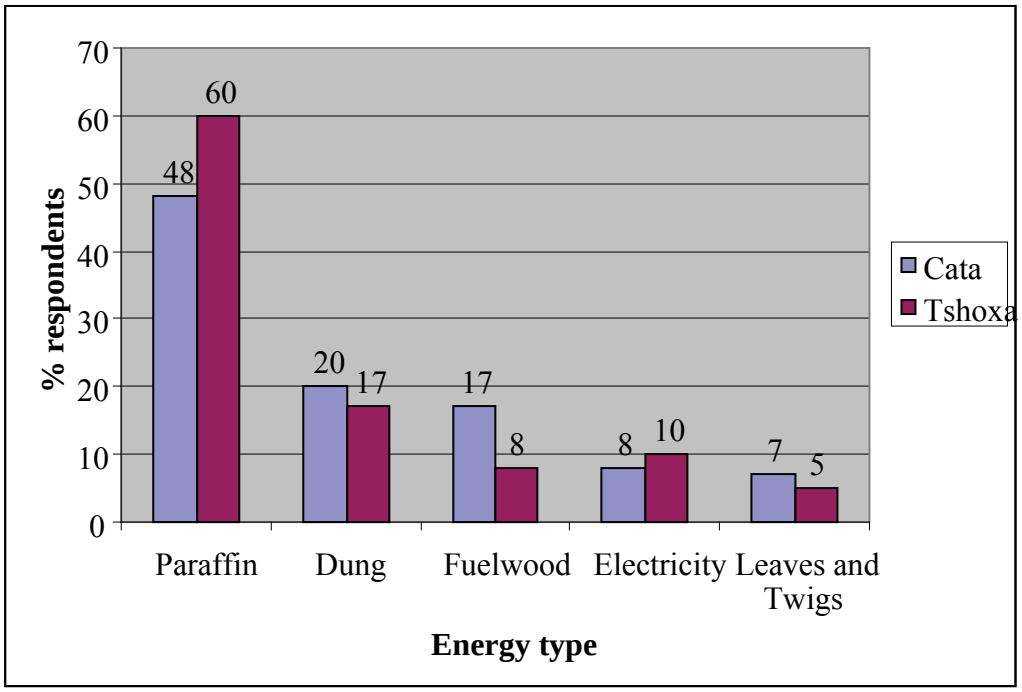

Figure 4.7 Alternative types of energy in case of fuelwood scarcity

4.3 Cooking habits practiced in rural households

4.3.1 Type of cooking stoves used

There was a significant difference ($p = 0.0006$) in cooking habits employed in the two rural villages. Since the Cata community uses more fuelwood as compared to the community at Tshoxa, the study found that 77% of the respondents in Cata make use of open wood fire to cook while only 42 % of the respondents in Tshoxa use open wood fire (Figure 4.8) . Paraffin stoves were mostly used in Tshoxa (15%) while only 5% of the Cata community used paraffin stoves. More respondents in Tshoxa (40%) use electric stoves for cooking compared to only 18% in Cata.

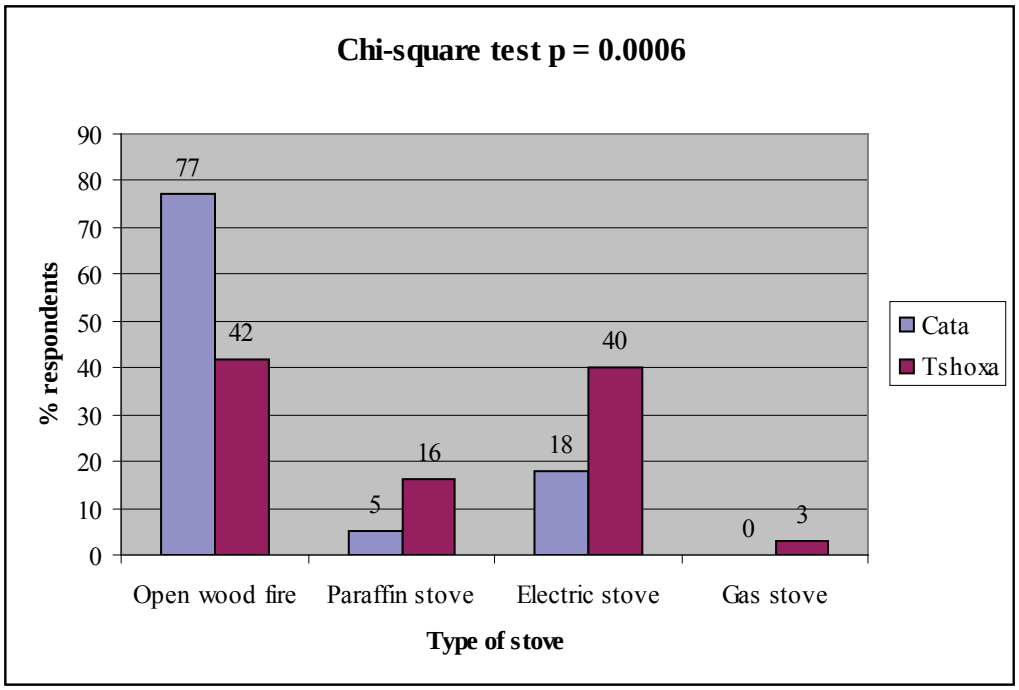

Figure 4.8 Type of cooking stoves used in Cata and Tshoxa villages

4.3.2 Type of pots used for cooking

A significant difference ($p = 0.0001$) regarding type of pots used for cooking between the two rural was noted. The majority of the respondents (77%) in Cata use three-legged pots (see Plate 4.3) to cook their meals compared to 42% of the respondents at Tshoxa. Up to 58% of the respondents, those who mostly use paraffin, electricity and gas for cooking, use the normal metal pots for cooking. Only 23% of the respondents in Cata do not use three-legged pots, but use metal pots for cooking their food.

Plate 4.3 A three-legged pot on open fire

4.4 Conservation of fuelwood after cooking

There were no significant differences between the two rural villages in the conservation of fuelwood after cooking. All the respondents in both communities indicated that they extinguished the fire after cooking. There was however a significant difference (p - 0.0002) between the two villages in gathering of all ingredients and tools. In Cata, 65% of the respondents indicated that they gathered all ingredients and tools before the fire starts and cooking commences compared to only 32% in Tshoxa.

There was also a significant difference (p = 0.0452) in the warming habits for food between the two villages. The most used fuels for warming of food in Cata were fuelwood (40%) and electricity (40%) and paraffin (20%). However, in Tshoxa, the most used fuel for warming the food was found to be electricity (47%) followed by paraffin (28%) and fuelwood (20%).

4.5 Methods for conserving energy for long cooking food items

4.5.1 Fuels most used for the preparation of umngqusho

Ummgqusho is a traditional staple food for the Xhosa people. It is a meal consisting of samp and beans. It is boiled for more than three hours. Although people would use different fuels to cook samp, fuelwood seem to be the preferred fuel in both villages even though there is a difference in the amount of fuelwood consumed for this purpose. Up to 95% of the respondents in Cata use fuelwood for the preparation of umngqusho while only 60% in Tshoxa use fuelwood. In Cata, the people only use three type of fuel (Fuelwood, paraffin and electricity) to cook umngqusho while in Tshoxa as many as six types of fuels (Fuelwood, paraffin, electricity, leaves and twigs, gas and dung) are used (see Table 4.1). The amount of electricity consumed for the cooking of umngqusho is more in Tshoxa (17%) as compared to Cata (2%). The amount of paraffin consumed for the cooking of umngqusho is also more in Tshoxa (13%) as compared to Cata (3%).

Table 4.1 Percentage of types of fuel mostly used by the two villages to cook umngqusho

	Cata	**Tshoxa**
Fuelwood	95%	60%
Paraffin	3%	13%
Electricity	2%	17%
Leaves and Twigs	0%	5%
Gas	0%	3%
Dung	0%	2%

4.5.2 Food preparation prior to cooking

There were no differences between the two rural villages regarding the soaking of grains prior to cooking. Only 42% in Cata and 40% in Tshoxa soaked their grains prior to cooking. There was no significant difference between the two villages concerning the pounding of grains prior to cooking. The majority of the respondents in Cata (58%) and Tshoxa (60%) villages indicated that they did not pound their grains prior to cooking (see Figure 4.9)

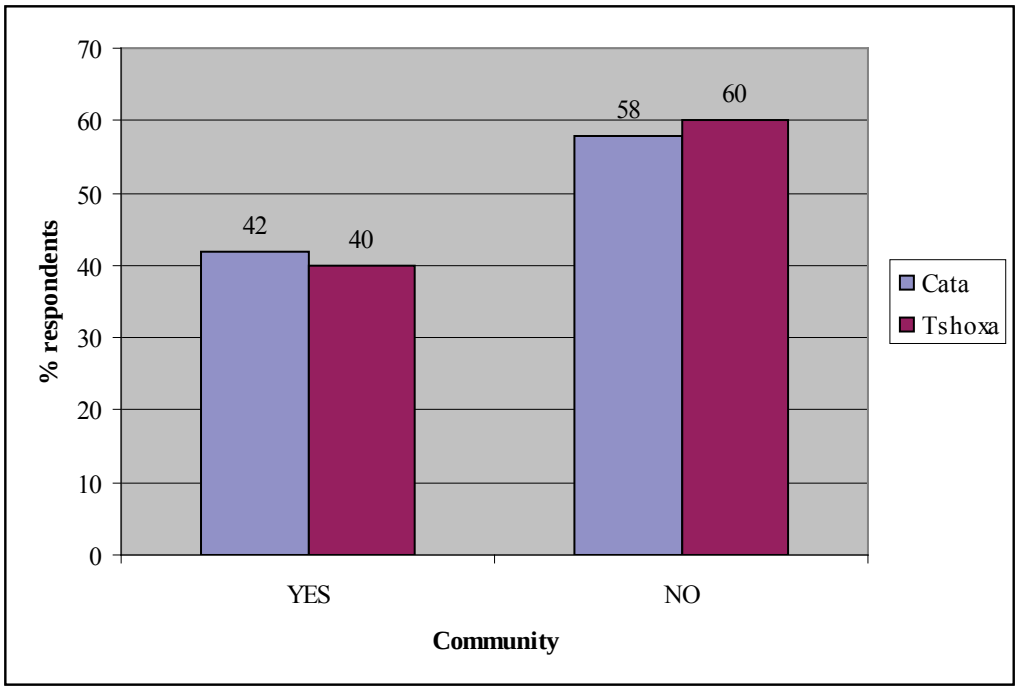

Figure 4.9 Soaking of grains prior to cooking in the two communities

4.6 Perception of the community on woodlots and natural forests

The woodlots and the natural forests in Keiskammahoek offer the opportunity for the local community to participate in sustainable forest management and benefit products and services from them. This section presents the findings of the study that was done to identify the local community's perception regarding community woodlots and natural forests.

4.6.1 Products and services from community woodlots and natural forests

There was a significant difference ($p = 0.0074$) between the two villages regarding products and services obtained from woodlots. While the majority of the people in Cata obtain poles, timber and thatching grass from the woodlots and natural forests, most of them (44%) singled out fruit trees followed by medicine (37%), poles (8%) and timber (7%) (Figure 4.10). A very few respondents mentioned environmental goods and services. However, it was a different case in Tshoxa where 45% of the respondents cited medicine as the most important product that they were obtaining from the natural forests; and only 20% indicated that they were also getting fruits from the forests.

In Cata, the respondents (50%) indicated that the importance of woodlots around them was the fact that they obtained fuelwood from them followed by poles (25%) for their building and construction purposes. The other importance of the woodlots was that they played a major role in protection of the environment with 10% of the respondents linking woodlots to the protection of the environment. Woodlots were also important for the provision of thatching grass (8%) and food and fruit (5%).

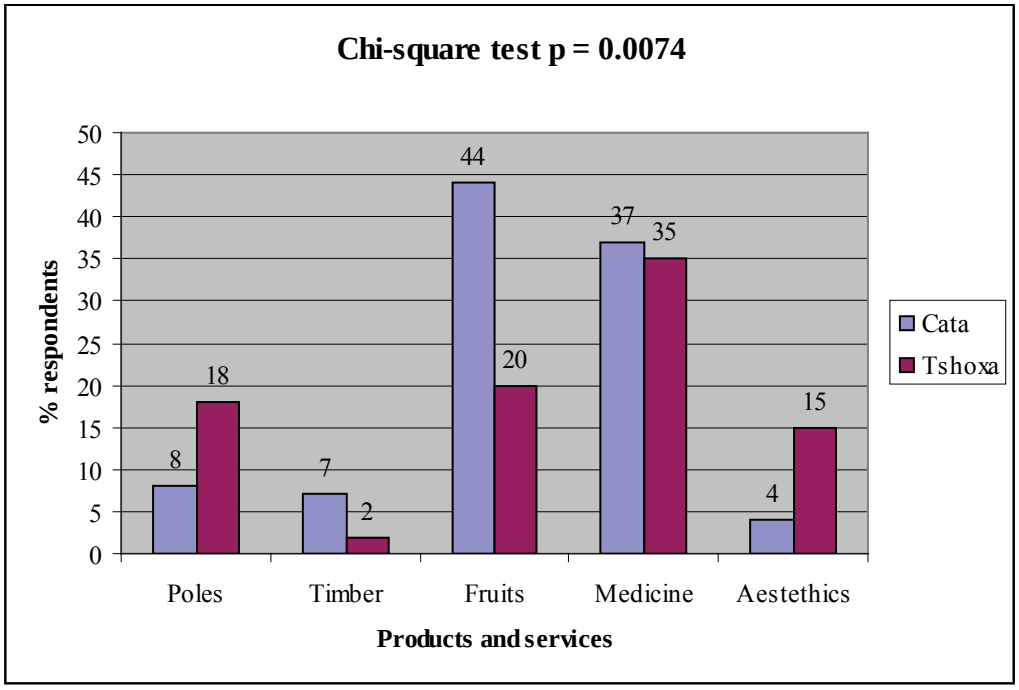

Figure 4.10 Products and services obtained from woodlots and natural forests

4.6.2 Interests by the local community in community tree planting

The respondents from Cata expressed interest in having other trees planted in their woodlots. The majority of the respondents (65%) in this rural village indicated that they would like to see other trees planted in their woodlots while 35% did not want any trees planted in the woodlots. The respondents from Tshoxa however had a different opinion regarding the planting of other trees in their natural forests with 60% of the respondents indicating that they did not want any trees planted in their natural forests.

4.6.3 Type of trees to be planted in the woodlots and natural forests

There was no significant difference of between the two communities regarding the planting of other trees in the woodlots and natural forests. The majority of the respondents (88%) in Cata stressed the importance of having fruit trees planted in their woodlots and natural

forests while in Tshoxa 79% of the respondents indicated that they would like to plant species such as *Pinups spatula, Eucalyptus grandis, Quercus robur*. Other trees of importance to the local community were fodder trees. The remaining 4% wanted fodder trees for their livestock while the other 4% did not have any knowledge as far as tree planting was concerned.

4.7 Tree planting by households

This section reports survey findings on tree planting by rural households. In the two study sites, the rural community planted trees for purposes of shelter and protection from the wind. There was a significant difference ($p = 0.0194$) between the two villages concerning tree planting by the households. Only 57% of the people in Cata have planted trees in their yards compared to 77% in Tshoxa (see Plate 4.4).

Plate 4.4 Seedlings planted by a household in Tshoxa

4.7.1 Gender and tree planting

There was no significant difference between the two villages regarding the planting of trees by gender. Tree planting was dominated by men accounting for 71% of the trees planted in Cata; followed by women (20%) and children (9%); while tree planting in Tshoxa was also dominated by men (59%) followed by women (41%).

4.7.2 Locations where trees are planted

When asked about the locations where trees were planted, respondents gave one of the two answers. “Around the house” means the trees are not planted far away from the houses and “In own yard” means the trees are planted in the family fields a little further away from the houses. About 97% of the respondents’ trees in Cata were planted around their houses while 65% of the respondents in Tshoxa also planted their trees around their houses.

Plate 4.5 *Prunus persica* tree planted in the yard far from the house

4.7.3 Sources of tree seedlings

Households obtained their seedlings from various sources such as neighbours, relatives, the forest division and schools. About 28% of respondents in Cata compared to 33% at Tshoxa grew their own seedlings. Up to 12% of the respondents in Cata obtained their seedlings from relatives compared to only 2% in Tshoxa. About 26% (Cata) and 17% (Tshoxa) of respondents sourced their seedlings from neighbours. Respondents from Cata (9%) and Tshoxa (11%) bought seedlings. In Tshoxa, 28% of the households obtained their seedlings from DWAF compared to 16% in Cata. The remaining respondents (9%) from Cata sourced seedlings from the school while only 3% from Tshoxa obtained seedlings from schools. The Tshoxa community also obtained their seedlings from a farm adjacent to them. Table 4.2 gives details of other sources of tree seedlings.

Table 4.2 Sources of tree seedlings

Seedling Source	Cata	Tshoxa
Grew them	28%	33%
Relatives	12%	2%
Neighbour	26%	17%
Bought	9%	11%
DWAF	16%	28%
School	9%%	3%
Farm	0%	6%
Total	100%	100%

4.7.4 Difficulties associated with tree planting

There was a significant difference (p <=0.0005) between the two villages regarding difficulties that were associated with tree planting. Various difficulties that resulted in failure to plant own trees were listed by respondents with the main one being lack of seedlings. Up to 39% of the respondents at Cata mentioned lack of seedlings as a difficulty and barrier in having trees planted compared to 32% at Tshoxa (Figure 4.10). As many as 24% of the respondents from Tshoxa mentioned that there was not enough land to plant the trees; while 27% from Cata compared to 7% at Tshoxa feared cattle grazing on the seedlings. Up to 17% of the respondents in Tshoxa and 5% in Cata indicated that they had no knowledge concerning tree planting.

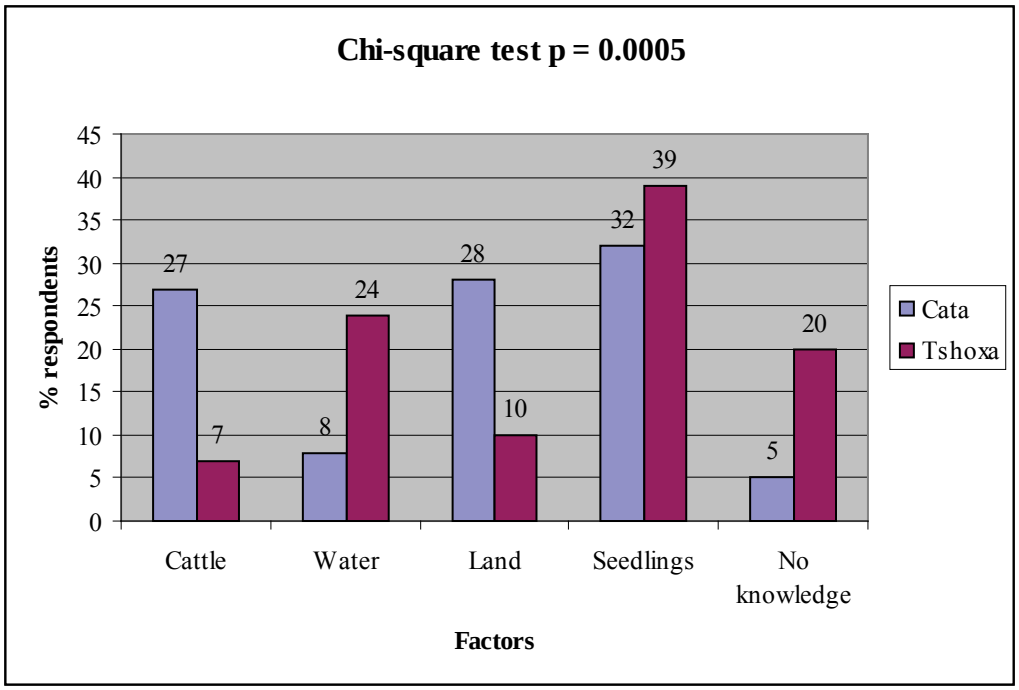

Figure 4.11 Difficulties associated with tree planting at a household level

4.8 Key informant interviews

An interview was conducted with the key people (community leaders) of the community. The people were extremely receptive and appreciated having the opportunity to participate. There were different points of view regarding the availability of fuelwood. Some stated that fuelwood was scarce while some indicated that fuelwood was not scarce at all. However, all the key informants agreed on one thing: the role played by forests in providing the rural communities with energy needs.

4.9 Conclusions

It is evident from this chapter that despite the electrification in the two study areas, fuelwood remains the main primary fuel in the rural settings Keiskammahoek and that women are the primary collectors. The forests play a major role in the livelihoods of the people by providing them with products and services derived from these forests. Trees are not only valued for basic energy needs, but also for nutritional value (fruits). Both villages value the importance of tree planting at household levels while Cata community is involved in communal tree planting. The woodlots and the natural forests are perceived to be playing a major role for these communities.

CHAPTER FIVE

DISCUSSION

This chapter presents the discussion following the results in the previous chapter (Chapter 4). The socio-economic and livelihood context of fuelwood are discussed, followed by the cooking habits employed in the rural households. It then proceeds with the discussion of the attitudes and perceptions of the local people regarding the use woodlots and natural resources including the perception of the communities on tree planting.

5.1 Socio-economic and livelihood context of fuelwood use

In most communal areas of South Africa, there is unlimited and open access to natural resources that include wood, especially for fuel energy (Dovie *et al*, 2004). The research results indicate that fuelwood is the primary energy source for the households living in rural areas where the study was conducted. The most widely used form of bioenergy is fuelwood, although in areas with scarcity of wood, other biomass forms such as crop residues and dung become more prevalent (Bhatt and Sachan, 2004; Shackleton *et al*, 2004). Biomass as a source of energy is also enjoying renewed interest in the developed world as a source of renewable energy (Bernades *et al*, 2003).

Research conducted in Zimbwabwe, Kenya, Mozambique, Tanzania and South Africa, to name a few, has shown that the vast majority of rural households rely extensively on fuelwood as their basic energy source (Sheya and Mushi, 2000; Vermeulen *et al*., 2000; Kituyi *et al*., 2001; Brouwer and Falcaõ, 2004; Shackleton *et al*., 2004). In many instances it has been argued that the widespread use of fuelwood is linked to a number of environmental problems, including deforestation, biodiversity loss, climate change and land degradation (Sankhayan and Hofstad, 2001). The presence of these environmental problems at any given site may have detrimental consequences for livelihood security and sustainability (Madubansi and Shackleton, 2007). This contribution of fuelwood use to environmental degradation has however been questioned in some instances. Luoga *et al* (2000) has argued that fuelwood use is usually only a minor contributor to these problems, except where urban demand is significant.

5.1.1 Rural electrification and fuelwood use

Even though the households from the two case study rural areas have access to electricity, they still prefer to use fuelwood as the source of energy for their household purposes. About 77% and 42% of the households in Cata and Tshoxa respectively still used fuelwood for thermal purposes, especially cooking. Madubansi and Shackleton (2007) conducted studies in five rural areas in the Bushbuckridge area and found that over 90% of the households still used fuelwood for cooking and also found that the mean household consumption rates over the 11-year period had not changed, even with a policy of 6 kWh per month of free electricity. The use of fuelwood in Cata's households was higher (77%) than that of the Tshoxa community (42%); while about 38.2% of the households in Tshoxa use electricity as their primary energy source as compared to their counterparts in Cata where only 18.4% use electricity for cooking. This might be because of the different lifestyles between the rural villages. Situated far from town and surrounded by forest plantations, Cata still prefer using fuelwood for their cooking, while Tshoxa, situated 2 kilometers away from town, the people in this village use fuelwood, paraffin and electricity for their cooking. The preference of fuelwood for energy is due to several reasons other than economics of use such as entitlement, tradition and accessibility (Dovie *et al*, 2004). Fuelwood usage is therefore specific to people in specific locations and in relation to other resources. In a description of fuelwood usage, Soussan (1988: 59), states that: '*They (fuelwood) reflect the resource and socio-economic characteristics of specific localities and cannot be separated from other aspects of resource management and peoples' lives. What this means is that rural energy (and in particular biomass fuel) can be fully understood only as a component of an integrated rural production system.*'.

The findings also revealed that fuelwood was used for heating or warming during winter periods. About 78% of the respondents in Cata reported that they also used fuelwood for warming their homes. In Tshoxa, only 56% of the respondents reported that they also used fuelwood for heating their homes. The reason for these households using fuelwood for heating might be because the other types of energy are too expensive for them to afford. Highly efficient energy sources like kerosene or liquid gas are rare and expensive in Africa (Uherek, 2006). Electricity was mainly used by both rural villages for lighting in their homes. The majority of the households (93%) from both villages used electricity for their

lighting purposes. The respondents from Cata indicated electricity was affordable if they used it mainly for lighting.

Despite electrification, some households still purchase fuelwood. The research results indicate that a household in Cata would spend an average of R250 per month on fuelwood purchasing while a household in Tshoxa would spend an average of about R111 per month. By purchasing, these households indicated that they are able to save time and can afford to buy more as a function of being readily employed.

5.1.2 Fuelwood collection, harvesting methods and gender issues

The findings obtained through the interviews indicated that a majority of the respondents from Cata (53%) picked their fuelwood off the ground unlike their counterparts in Tshoxa who mostly (57%) harvested their fuelwood through cutting from live trees. The survey was conducted in July during the windy periods in which more dead wood falls on the ground due to strong wind. As a result of this, the majority of people collected dead wood from the ground instead of knocking off the trees or cutting from the trees. On the other hand, in Tshoxa where *Acacia karoo* is used as a fuelwood species, the people harvested their fuelwood through cutting from live trees. This does not necessarily mean that there are no branches falling off from trees, the people generally indicated their preference to wet *Acacia karoo* wood because it burns well even in its wet status. Recent studies conducted by Madubansi and Shackleton (2007) found that in Bushbuckridge, fuelwood gatherers frequently cut live wood because of the relative scarcity of dead wood. Dovie *et al* (2004) further states that in recent years, harvesting of fuelwood has gone beyond the simple collection of only dead wood, and encompassed the chopping of live trees. Although cutting of live wood is restricted by the DWAF the Tshoxa community is allowed to cut live wood as long as it is *Acacia karoo*. Apart from that, the cutting of other indigenous species is regarded illegal. Interestingly, although most of the people from Cata had access to fallen dead wood, some of them would illegally cut live indigenous species. Some of the community members prefer to cut species such as *Podocarpus falcatus, Podocarpus latifolius* to build kraals for their livestock. Most of the wood collection (75-85%) at the two sites is by means of headload bundles. Dovie *et al* (2004) also agrees that villagers would normally harvest and collect fuelwood in headloads, pick up vehicles and wheelbarrows.

The main collectors of fuelwood from both rural villages are women. According to Masekoameng *et al* (2005), women and children are the ones who bear the difficulties of chopping, loading and transporting heavy loads of wood. The authors further state that men get involved only when the fuelwood is collected for sale or where social constraints restrict women from leaving their homes (for example, when they are heavily pregnant). Gender issues are not new to wood energy development. Women's involvement is not only important in the collection of fuelwood but also in its efficient utilization (Oosterveen, 1995). Women are also more concerned about the growing and management of multipurpose trees to meet the domestic requirements while men are more involved in the decision making roles regarding the growing and management of these multipurpose trees. Sometimes conflicts of priorities arise between men and women that stem from the use of different forest products. The differences between men and women justify the need for specifically involving women in social forestry projects, not only for reasons of equity, but also because of their collection, use and distribution of fuelwood, their role in the management of fuelwood resources (although less frequently recognized) and their role in income-generating activities (Borg, 1989).

5.1.3 Fuelwood sources and availability

The communities obtain their fuelwood from woodlots and indigenous forests (*Acacia karoo* veld). Almost all the respondents from the two rural villages indicate that the woodlots and natural forests are sufficient for present and future use. This type of attitude and perception could lead to exploitation of common property resource since some of the respondents (50% and 58%) from Cata and Tshoxa respectively felt that fuelwood was becoming a scarce resource. Preference of certain species by local collectors also contributes to the scarcity of such species. An increased use of a preferred species such as *Podocarpus latifolius* and *Podocarpus falcutus* could lead to increased burning of that particular species. Even so, in the face of increasing scarcity of preferred species, collectors resort to less popular species thus widening the range of collected species (Shackleton and Prins, 1992).

5.1.4 Alternative energy types in case of energy scarcity

In addition to fuelwood, rural households use paraffin, candles, batteries and reticulated electricity for other applications but frequently find these expensive (Howells *et al*, 2005). It has been shown by the results that the respondents had other alternative fuels to use in case of their preferred energy scarcity. The majority of fuelwood users in the study area indicated that they would use other energy sources such as paraffin (48-60% see Figure 4.7 in Section 4.2.6), dung, electricity and leaves and twigs. Interestingly, dung was also an optional fuel during fuelwood scarcities. South Africa is not the only developing country with majority of people using fuelwood and other energy sources. In Mexico, 25 million people use fuelwood in an open fire mainly for cooking; with 18 million people using fuelwood exclusively and 7 million in combination with LPG (Troncoso *et al*, 2007). The use of these alternative energy sources is based on the socio-economic status of the community. A few community members indicated that they would not use paraffin or electricity, but would rather use energy sources such as dung and leaves and twigs. They further indicated that they even go to an extent of collecting waste around the yard and burn it for cooking. Troncoso *et al* (2007) states that the use of other forms of energy has been slow and oriented towards complementing rather than substitute fuelwood, in what has been called "multiple fuel strategy". A multiple fuel strategy is a model by which new cooking technologies and fuels are added, but even the most traditional systems are rarely abandoned (Masera *et al*, 2000). This type of strategy is also practiced in case study communities whereby they (the community) do not switch fuels but more generally follow a multiple fuel strategy.

5.2 Cooking habits in the rural areas

The results indicate that despite electrification in Keiskammahoek, a majority of people still rely on fuelwood for their daily cooking. The results also revealed the role of fuelwood in cooking at the household level. It was noted during the survey that the traditional Xhosa diet revolves around umngqusho (mixture of samp and beans), baked bread, porridge, rice, meat and vegetables. Food is always cut into smaller pieces prior to cooking and no food tenderizers are used during food preparation. The preferred staple food is umngqusho, but porridge is also widely eaten in this region. Fuelwood is the most used form of fuel for the preparation of umngqusho that constitute of hard grains and beans.

Most people in both communities (58-60%) do not soak their hard grains and beans prior to cooking nor do they pound these hard grains and beans (see Figure 4.9 in Section 4.3.2). The explanation included the fact that these are modern times. Only the elderly people still practiced the pounding of grains and beans because they indicated that they grew up doing this and would not like to lose their cultural values. Meals are generally prepared in three-legged pots for those households that use fuelwood as their primary energy source while those households using paraffin and electricity prepare their meals in aluminum pots over paraffin or electric stoves.

Cooking and the burning of the fires were usually done either in the kitchens or outside. Only the households making use of paraffin or electricity cook indoors. The households that use fuelwood as a primary energy source gather all their cooking equipments and utensils before the commencement of cooking. Interestingly, the lids of the pots were tightly fitted, not for energy conservation purposes, but to make sure that dust and other impurities did not come into contact with food while still over the fire. Water was added as needed while cooking. This was the case for all households regardless of whether they used fuelwood or other sources of energy for cooking.

There is no apparent energy conservation in the two study areas. This reason for this might be because these communities have not been exposed to energy conservation issues. Unlike other countries such as Kenya, the government of South Africa has not yet taken initiatives on fuelwood conservation measures such as the use of improved wood stoves. Education and awareness is geared towards sustainable management and conservation of forests, rather than in energy conservation measures.

In Kenya, Maendeleo wood stoves were introduced as a measure to save energy that is lost through the use of open wood fires. If correctly installed and properly used, the Maendeleo stove saves 40% to 60% of the firewood that would be consumed by the use of open wood fires (Habermehl, 1994). The conservation of energy does not only revolve around tight closing of lids, but also around improvement of technology. Lack of these technological improvements result in low efficiencies, fire hazards and exposure to heat and smoke. Improved cook stoves programmes could help bridge this gap.

There is a difference between the two communities in the energy source for warming food. The difference in the energy source for warming food in Cata (coals of fire) and Tshoxa (electricity) might be because of the fact that Tshoxa rural community is situated close to town and has as a result adapted to urban lifestyle.

5.2.1 Cooking stoves and pots used by households

The Cata Community uses more fuelwood compared to the Tshoxa community. This seemed directly related to the type of usage of the wood with most people at Cata using open wood fires. As a result of this, the majority of Cata respondents (77%) make use of open wood fires compared to only 42% at Tshoxa. Open wood fires contribute to the health risks that affect women mostly because they are the ones being exposed to smoke. Exposure to smoke from fuelwood fires is high for women and children with poor aeration and design of chimneys (Samson *et al*, undated). Open wood fires commonly used for household cooking have approximately 10% conversion efficiency, and are wasteful of energy during periods when low heat is required since there is no control of the oxygen supply (Samson *et al*, undated). The two rural villages studied are no different to other cases. The women face the same challenges experienced by other women in other developing countries. These women are not only dealing with poverty, but are also dealing with lack of efficient household energy technologies. In most rural communities in Sub Saharan Africa, poverty can mean among other things, having to rely primarily on wood and/ or dung for cooking, heating and lighting (Masekoameng *et al*, 2005).

Although the use of fuelwood for cooking has difficulties as discussed above, it also has some highlights. Fuelwood is a renewable source of energy and it is available in some form everywhere; can be burned without further processing. It is evident from literature (Troncoso *et al*, 2007) that the technologies and techniques for sustainable production and efficient use of fuelwood energy are available.

The majority of people at Cata (77%) make use of three-legged pots over open wood fires compared to only 42% at Tshoxa. Only the minority in Cata make use of metal or aluminum pots. The reason for this could be more use of fuelwood at Cata and hence the use of open fires and three-legged pots, while at Tshoxa, the area is electrified and therefore uses some electricity associated with aluminum pots. In addition to that, less use of

fuelwood in Tshoxa could be the fact that this place is more urbanized with access to employment and therefore more disposable income.

5.3 Perceptions of community regarding community woodlots/natural forests

Community woodlots and forests have the potential to contribute positively in the communities in which they are located. The people of Keiskammahoek view the community woodlots and the natural forests as a base for their livelihoods. In rural towns where the economy has been dominated by large-scale timber harvesting, forests may contribute to efforts to promote the community's long-term economic stability and environmental health (Hanna, 2005).

5.3.1 Important products obtained from the woodlots/natural forests

Fuelwood was reported as the most important product in both rural areas. The woodlots and natural forests are the main sources of fuelwood. Woodlots are an increasingly important source of woody biomass, as well as a critical soil and water conservation investment as deforestation and land degradation worsen (Jagger *et al*, 2003). The Tshoxa natural forests are also an important source of fuelwood. The most used species in this village was *Acacia karoo.* The other important products cited by the respondents were poles, thatching grass, food and fruit.

The respondents also indicated the importance of woodlots and natural forests in terms of environmental and aesthetic services. It has been long appreciated, both internationally and within South Africa, that forests offer numerous benefits to adjacent communities and society at large (Wollenberg and Ingles, 1998; Oksanen *et al*, 2003; Lawes, 2004). Such benefits include consumptive resources, spiritual and aesthetic needs, employment, and ecological services such as carbon sequestration and water regulation (Shackleton *et al*, 2007a).

Interestingly, while the people at Cata acknowledge the importance of forests for fuelwood and other NTFPs, they highly valued the forests as a source of fruit products. This could be due more to the nutritive value of the forest resource than as source of energy and/or

construction material. Forests contribute to food security and sustainable livelihoods in numerous ways, not only directly but also indirectly, through support to agricultural systems, their role in rural development and in maintaining environmental integrity and the provision of opportunities for income generation and employment (Séne, 2006). Forests also play a major role in the sustainability of agricultural production systems, but they could make a greater contribution to agroforestry and tree planting in agricultural systems. In addition, medicinal plants were also mentioned as vital to their families and in carrying out their cultural values. The most listed products in Tshoxa were medicinal plants. In this area, most household heads (men and women) were found to be traditional healers who reported that the natural resource was a source of the medicines that they use. The Tshoxa community also value aesthetics and spiritual benefits more compared to their Cata counterparts.

Indigenous forests were also utilized by both communities for a variety of purposes. According to Shackleton *et al*, (2007a), indigenous forests and savannas, along with plantation forests, offer numerous benefits to rural communities and society at large. The forest resources play a major role in Cata and Tshoxa because they offer significant returns whether in cash, direct use or indirect use values. Not only are the tangible benefits to rural communities important, but so too are the indirect benefits to rural communities (such as cultural sites and species, aesthetic benefits) and the significant benefits to society at large, encapsulated in the value of ecosystem services such as water regulation, pollination services and carbon sequestration (Scherr et al, 2003).

5.3.2 Preference of tree types/species for planting

Most of the community at Cata preferred to have fruit trees planted in the woodlots as opposed to Tshoxa who cited preference for other exotic species in their households; but also discouraged the introduction of exotics in the natural forests. The preference for fruit trees and other types of tree species in the woodlots is not uncommon. Allen (1990) conducted a study in two rural Swazi communities where he found a preference for two introduced wattle species (*Acacia mearnsii* and *Acacia decurrens)* in the woodlots and fruit trees and ornamentals. The most commonly planted fruit trees were *Persea americana*, *Musa sapientum*, and *Prunus persica*. This type of tree integration could be a good

approach in such a way that it encourages tree planting among the community members while at the same time alleviating poverty in rural areas. The indigenous fruit trees play an important role in poverty reduction as they are normally used as a safety net during lean periods (Akinnifesi *et al*, 2008; Chirwa *et al*, 2008b). Eradicating extreme poverty and hunger is the most important of the Millennium Development Goals that are currently the focus of the international development agenda (Schreckenberg *et al*, 2007). Interestingly, most respondents seem to have a knowledge regarding the impact of exotic species such as their over-use of water resources.

5.3.3 Status of the woodlots and natural forests

Both rural communities reported that the woodlots and the natural forests were sufficient for both present and future use. Ham (2000) also conducted a similar study and the findings of the study revealed that the current woodlots were sufficient to provide the community with its wood needs. This might not always be true for both villages because an increase in population might put the resource under pressure resulting in overexploitation leading to degradation of the environment. In most cases, the population is seen as an aggregate of consuming units, putting stress increasingly on the natural resources leading to environmental degradation (Huq *et al*, 1998).

5.4 Community tree planting

In Keiskammahoek, the communities view tree planting activities and community woodlots as a more effective mechanism for promoting sustainable land management and biodiversity. Development practitioners generally accept that local communities can play a central role in the effective management of natural resources (Johnson and Forsyth, 2002). Tree planting may also offer the opportunity of alleviating poverty in rural areas and strengthening governance of rural people. This section explores the rural people's perceptions and attitudes towards community tree planting.

5.4.1 Perceptions regarding community tree planting

The majority of the respondents from both rural villages reported that they had planted trees in their households. The respondents were aware of the role played by trees in their

surrounding environment. Trees also provide rural communities with a diverse range of environmental goods and services (Groninger *et al*, 2002). Tangible goods derived from trees include fuelwood, construction and carving timber, fruit, fodder, medicine, fibres, oils/dye and shade (Paumgarten *et al*, 2005). These goods, directly consumed, are a base for rural livelihoods. Respondents had various reasons why they planted trees in their households. In Cata village, 85% of the respondents indicated that they planted trees to harvest fruits and this was represented by 67% of the respondents at Tshoxa. The provision of shade during hot days also prompted villagers to plant trees. In other countries, trees are planted for energy security. Bewket (2003) conducted a study in Ethiopia in which planting trees on privately held land was an option for future energy security of the rural population in addition to multiple positive economic and environmental effects. Apart from shade and provision of fruits, fuelwood scarcity seems to be the main driver to plant trees in the African continent (Bewket, 2003).

Guthrie and Shackleton (2006) conducted a study in two areas: Makana District Municipality, Eastern Cape and in Mbombela, Mpumalanga where perceived benefits from tree planting at schools were observed. Most urban and rural schools declared that tree planting yielded benefits to them. The primary benefits reported were shade provision and using trees for education. Because of the acknowledged significance and value of trees to human and environmental well-being, government agencies, local municipalities, conservation bodies and non-governmental organizations (NGOs) worldwide sponsor or implement tree planting programmes, woodlots, agroforestry, plantations, urban forestry and household plantings (Guthrie and Shackleton, 2006; Campbell *et al*, 2002). An example of such tree campaigns in South Africa is the Arbor Day (Week), which normally takes place during September of every year (Guthrie and Shackleton, 2006)

5.4.2 Tree planting and gender

The majority of trees in the households were planted by men in both Cata and Tshoxa. The issue of gender in social forestry is not new. Fortmann *et al* (1997) conducted a study in two Zimbabwe villages where it was demonstrated that women were significantly less likely than men to plant trees on homestead land where security of their duration to tenure was uncertain. However, for the community woodlots, the study revealed that men and women are equally likely to plant trees. A study conducted by Hansen *et al* (2005) in

Malawi investigated how marriage and inheritance patterns affected tree planting behaviour by gender in two villages. The study showed that tree planting by men may indeed be dissuaded by uxorilocal[2] marriage patterns while tree planting by married women is not necessarily promoted under uxorilocal patterns. Rather, a high incidence of non-married women appeared to be associated with increased tree planting by women (see Hansen *et al*, 2005). In the two areas of this study, tree planting was not associated with marriage patterns. Hence, men, especially head of households planted the trees in the households; and women also participated in tree planting. However, there was no conclusive explanation on why the majority of trees in these households were still planted by men.

5.4.3 Sourcing planting material/seedlings

The respondents reported that they grew their own seedlings. Some respondents obtained their seedlings from neighbours and relatives. DWAF also played a major role in the distribution of free seedlings to the households. The majority of households from Tshoxa obtained their seedlings from DWAF as compared to households from Cata. This might be because Tshoxa village is not far away from the DWAF estate. This estate used to have a nursery and provided people with seedlings to plant trees on their properties. Some household bought their seedlings from various places while others got their seedlings from school tree planting projects. Other countries such as Tanzania have had household tree planting programme initiated by government. Based on the "firewood shortage" approach, the program has been producing tree seedlings and distributing them free to rural households (Yasu, 1999). The free distribution of seedlings stimulated households to adopt *Grevellia robusta* planting. Unlike Yasu (1999), who reported free distribution of seedlings, Gausset *et al* (2007), conducted a study also in Tanzania; which revealed that seedlings were usually not free of charge meaning that price of seedlings were a constraint.

The research results also reported various difficulties that resulted in failure to plant own trees. Both villagers mentioned lack of seedlings as the reasons why they found it difficult to plant their own trees. Even though some respondents in Cata were aware of the fact that DWAF was giving out seedlings free of charge, some of the respondents mentioned lack of seedlings as a difficulty and barrier in having trees planted. Respondents in Tshoxa also complained of lack of seedlings as a major difficulty. When asked whether they were aware

[2] Uxorilocal: A case where a man stays at his wife's homestead or village.

that DWAF was offering seedlings to the communities free of charge, they responded by saying that they were not aware at all. This calls for DWAF to intensify their tree planting projects that will reach all the people through participatory planning partnerships.
Other respondents from Tshoxa mentioned that other difficulties were arising from the fact there was not enough land to plant the trees. Other problems stemmed from fear of livestock damaging seedlings since some of them do not have good fencing systems. Respondents from Cata and Tshoxa indicated their fears of having cattle grazing on the seedlings. Other respondents in Tshoxa and Cata indicated that they had no knowledge concerning tree planting. Harrison *et al* (2008) further state that individuals and communities that set small nurseries generally lack resources, in terms of suitable land, finance for nursery establishment, human resources (management skills), and information resources, and sometimes a reliable water supply.

5.5 Conclusions

This chapter presented discussions emanating from the study with regard to the use of forest biomass energy (fuelwood). Fuelwood plays a significant role in household energy in the two study areas. Despite the electrification in these two rural areas, fuelwood continues to be the most dominant energy form for cooking and heating. It is mostly burnt in open fires. The fuelwood is collected from communal woodlots, forest plantations and natural forests and it mostly collected by women as headloads. As much as there is interest in community tree planting, there are still some issues that need to be addressed to make tree planting easier for rural communities. There is no much awareness as far as the distribution of seeds by government is concerned. This calls a need for participatory planning partnerships with the communities. Other difficulties that were identified were having fear that seedlings would be damaged by livestock due to lack of good fencing systems around the households. Lack of resources such as suitable land, finance for nursery establishment, and information resources created a barrier for tree planting.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

The government of South Africa has identified the Eastern Cape and Kwa Zulu-Natal provinces as key for development in the forestry, wood and paper sector, with reforestation as a vital part of the strategy. With this development opportunity in the Eastern Cape Province, forestry, if managed in a sustainable manner, could provide renewable energy to the rural communities. This study addressed the use of fuelwood and its key role in meeting the energy requirements (cooking and heating) of the rural communities of the Eastern Cape. The rural households in the Eastern Cape are highly dependent on forest resources for their livelihoods including energy needs

The objective of this study was to establish the extent of use of fuelwood as a source of energy in rural households and the perception of communities on the use of existing woodlots and the new afforestation programmme of the Eastern Cape. In the light of this, the study addressed the use of fuelwood in rural households; cooking habits by the households; perceptions of rural communities with regard to the use of community woodlots and new afforestation and community tree planting.

The study was conducted in the two rural villages (Cata and Tshoxa) of Keiskammahoek in the Eastern Cape. The Cata rural village is surrounded by forest resources while the Tshoxa rural village is not. The two study areas differ in the lifestyle in such a manner that Cata is a land restitution village and deep rural while Tshoxa is a peri-urban village situated about two kilometers away from Keiskammahoek town. A sample of 60 households was randomly selected from each rural village. Data was collected through the use of questionnaires and the application of participatory focus group.

The main findings of the study were that at despite the electrification initiatives in these communities, many households especially in Cata still prefer to use fuelwood for cooking especially with long cooking food items such as umngqusho. Women remain the main collectors of fuelwood. In case of fuelwood scarcity, the communities would use other types of biomass such as leaves and twigs and dung. The majority of the households in Cata

make use of open wood fires to cook while more respondents in Tshoxa use electric stoves for cooking (see section 4.3.1). Technologies for efficient energy such as Improved Wood Stoves have not been introduced. The forestry sector in the Eastern Cape continues to make a significant contribution to the rural development. Both rural communities view tree planting activities and community woodlots as a more effective mechanism for promoting sustainable land management and biodiversity.

6.1 Conclusions

It was evident from this study that fuelwood, with women as principal collectors, is the most used forest resource for present and future energy security (see Sections 4.2 and 5.1). The study also showed that despite electrification in the Keiskammahoek region in the Eastern Cape, fuelwood remains the primary source of energy and that forests are a key resource for rural people's livelihoods. Hence, the communities will continue to use fuelwood as a main source of energy for cooking; while electricity is used as a source of energy where available (Tshoxa) for the warming and cooking of short term foods.

The study did not find any evidence of deliberate energy conserving practices such as soaking of hard food such as hard beans and grains prior to cooking. However, it was common practice to cut food into smaller pieces and to tightly closed lids during cooking; while fires were extinguished after cooking.

The study has also shown that most of the fuelwood is used for cooking and heating purposes by burning in open fires using three-legged pots. However, open fires are inefficient because they waste a lot of calorific energy and hence require large quantities of wood (Wahyudi, 2005). In addition to large quantities of wood being used, fuelwood emit smoke within the households and into the atmosphere.

The study also concluded that fuelwood was the most important product from the forests in both rural areas. However, the people at Cata also acknowledged the importance of forests for other NTFPs, especially as a source of fruit products. This is in agreement with other studies that have shown that indigenous fruit trees play an important role in poverty

reduction as they are normally used as a safety net during lean periods (Akinnifesi *et al*, 2008; Chirwa *et al*, 2008b).

Finally, the study showed that communities from both rural villages have an interest in planting trees around their households; with preference for fruit and shade trees. Interestingly, while most of the trees in both villages were planted by men, there was no conclusive explanation on why this was the case; as the finding also found that both men and women were equally likely to plant trees when community woodlots were considered,

6.2 Recommendations

In keeping with its diverse climate and vegetation, the Eastern Cape has major areas of land under both commercial forestry plantations (170 000 hectares) and indigenous natural forest (130 000 hectares) (Eastern Cape Development Corporation, 2008). The province is the only area in South Africa where plantations can be significantly expanded. This expansion will also open up opportunities for the rural poor that are living closer to the forestry plantation. Forests play a major role in providing communities with various products including wood for energy purposes. Wood is the backbone of rural energy economy and is still used in urban areas in surprisingly large quantities (Samson *et al*, undated). To optimize fuelwood use for household purposes (cooking and heating), the following recommendations are suggested:

- It is of great importance that the social and economic aspects of fuelwood use are understood. Researchers, decision makers, foresters, conservationists, energy specialists and other role players need to understand and know the types of food being cooked, where the cooking occurs, the family economies, health risks and environmental impacts. All these factors play a significant role in fuelwood use

- Gender differences need to be taken into consideration when implementing fuelwood projects. The fuelwood users and managers (women) need to be consulted and given a hearing because they have local knowledge regarding use of fuelwood

- Modern technologies such as improved wood stoves have not been introduced in the Eastern Cape Province and there are no energy conservation measures in place.

Hence, there is a need to address issues surrounding inadequate availability of modern technologies for wood-based energy systems which poses major problems to the rural communities. It is critical that the development of technological solutions that address the problems of open fires be implemented. In addition, the relevant R &D agencies should be provided with sufficient funds for making modifications in existing practices with regard to efficient collection and use of fuelwood. Greater focus should be towards the improvement of rural households in the Eastern Cape that will bring about a cleaner and more sustainable pattern of energy use in this province. Education and awareness should not only be towards the sustainable management of forests, but it should also be geared towards energy conservation measures

- Partnerships and participatory planning regimes must be established between rural people (rural communities) whose lifeline depends on forests and government (Forestry Department); NGO's/CBO's; university departments of forestry and other stakeholders

- Forestry planning regimes and policy writing should be come inter-disciplinary. Forestry experts in government, private sector and academia can do well if trans-disciplinary research leads to partnerships with social scientists

- Finally, agroforestry systems need to be implemented within the Cata woodlots whereby trees can be integrated with fruit trees. This could be an income generating project for the community and could also play a role in poverty alleviation within the community ensuring food security and could also play a vital role in combating malnutrition.

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APPENDICES

APPENDIX A

LIST OF TREES FOUND KEISKAMMAHOEK FORESTS

SCIENTIFIC NAME	COMMON NAME
Maytenus peducularis	Cape Blackwood
Maytenus undulata	Koko Tree
Putterlicka pyracantha	False Spike-Thorn
Pterocelastrus tricuspidatus	Candlewood
Cassine ethiopica	Kooboo Berry
Cassine crocea	Small-leaved Saffron
Cassine piragua	Cape Saffron
Cassine papillosa	Common Saffron
Pleuriostylia capensis	Coffee Pear
Apodytes dimidiatia	White Pear
Allophylus decipiens	False Currant
Hippobromus pauciflorus	Basterperdepis
Ziziphus mucronata	Buffalo-Thorn
Scutia myrtina	Cat-Thorn
Rhamus prinoides	Dogwood
Rhoicissus tomentosa	Common Forest Grape
Grewia occidentalis	Cross-berry
Diospyros whyteana	Bladder-nut
Chionathus foveolatus	Common Pock Ironwood
Olea Africana	Wild Olive
Olea capensis capensis	False Ironwood
Olea capensis macrocarpa	Ironwood
Salvodora angustifolia	Transavaal Mustard Tree
Azima tetracantha	Needle Bush
Strychnos henningsu	Red Bitterberry
Nuxia congesta	Common Wild Elder
Nuxia floribunda	Forest Elder
Buddleja saligna	False Olive

Buddleja salviifolia	Sagewood
Acokanthera oppositifolia	Common Poison-Bush
Carissa bisponosa	Forest Num-num
Halleria lucida	Tree Fuchsia
Burchellia bubaline	Wild Pomegranate
Hyperacanthus amoenus	Thorny Gardenia
Gardenia thunbergii	White Gardenia
Rothmannia capensis	Cape Gardenia
Vepris lanceolata	White Ironwood
Teclea natelensis	Natal Cherry-Orange
Clausena anisata	Horesewood
Commiphora harveyi	Red-stem Corkwood
Ptaeroxylon obliquum	Sneezewood
Ekebergia capensis	Cape Ash
Suregade Africana	Common Canary-berry
Excoecaria bussei	Pepper-seed tree
Harpephyllum caffrum	Wild Plumb
Protorhus longifolia	Red Beech
Rhus chirindesis	Red Currant
Rhus tomentosa	Real Wild Currant
Rhus indulata	Kuni-bush
Ilex mitis	Cape Holly
Maytenus acuminota	Silky Bark
Maytens heterophylla	Common Spike-Thorn
Maytenus nemerosa	White Forest Spike-Thorn
Canthium inerme	Common Turkey-berry
Canthium mundianum	Rock Alder
Psydrax obovata	Quar
Pavetta lanceolata	Weeping Bride’s Bush
Pavetta capensis	Black Bird-Berry
Brachylaena glabra	Malabar Tree
Ochna arborea	Cape Plane
Ochna natalitia	Natal Plane
Kiggelaria Africana	Wild Peach

Scolopia mundii	Red Pear
Scolopia zeyheri	Thorn Pear
Trimeria grandiflora	Mulberry-leaf Trimeria
Dovyalis caffra	Kei-apple
Dovyalis lucida	Glossy Sourberry
Olinia emarginata	Mountain Hard Pear
Cassipourea flanaganii	Cape Onionwood
Eugenia zeyheri	Wild Myrtle
Cussonia spicata	Common Cabbage Tree
Curtisia dentate	Assegai
Rapanea melanophloeos	Cape Beech
Mimusops oboovata	Red Milkwood
Eucla natalensis	Natal Guarri
Diospyros dichrophylla	Common star-apple
Podocarpus falcatus	Outeniqua Yellowwood
Podocarpus latifolius	Real Yellowwood
Celtis africana	White Stinkwood
Chaetaeme aristata	Thorny Elm
Ficus sur	Broom Cluster Fig
Xylamos monospora	Lemonwood
Cryptocarya woodii	Cape Quince
Maerua racemulosa	Forest Bush-cherry
Pittosporum viridiflorum	Cheesewood
Cunonia capensis	Red Alder
Trichocladus ellipticus	White Hazel
Prunus Africana	Red Stinkwood
Schotia latifolia	Bush Boer-bean
Calpurnia aurea	Cape Labernum
Zanthoxylum capensis	Small Knobwood
Zanthoxylum davyi	Knobwood

APPENDIX B

QUESTIONNAIRE

Fuelwood use and Cooking Practices in Rural Households

(Details of questionnaire to be discussed with client)

1.0 General Information

1.	Date of Survey (dd/mm/yy)	
	Village Name	
	Respondent ID	

2.	How many people live in your household?		

3.	How many people do you cook for?	2 or less	3 to 6	7 and up

4.	How many times a day does the household cook?		

2.0. Use of fuelwood energy in rural communities

5. What type of fuel do you use for cooking?

Fuelwood	Charcoal	Waste	Paraffin	Grass
Peat	Leaves/Twigs	Dung	Electricity	Other

If other specify

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6. What do you use for lighting?

Wood	Electricity	Paraffin	Candles	Gas	Other

If other specify

……

7. What do you use for heating?

Fuelwood	Charcoal	waste	paraffin	grass
peat	Leaves/Twigs	Dung	Electricity	Other

If other specify

8. Fuelwood harvesting

Name of harvesting place / forest	Distance to harvesting place (KM)	Duration of harvesting (Hrs)	How often per week	Quantity (No of headloads or bakkies loads)

9. Who are the main collectors of fuelwood?

Women		Men		Children	

10. Means of obtaining fuelwood.

Gathered by household		Purchased		Both but more by gathering		Both but more of purchasing	

11. . How much do you pay for fuelwood per month?

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12. How is fuelwood harvested?

Picked off the ground (Dead)		Knocked out of trees using sticks	
Cut from trees and bushes		Other (please specify)	

If other specify

……

13. How is fuelwood collected?

Headloads		Bulk (for example with a bakkie)	

14. In what form does wood arrive at home?

Shorter dead branches of live trees		Twigs (shorter than 40 cm)		Logs	
Longer dead branches of live trees		Bark of trees		Roots	
Longer green branches of live trees		Seed pods		Other (please	

				specify)	
Shorter green branches of live trees		Tree stumps			

If other

……

15. Fuelwood storage at home

How long is wood kept before it is used and where and how is it stored?	
Is fire wood protected from rain?	
Duration of storage when firewood is dry (in weeks)	
Duration of storage of firewood when wet (in weeks)	
How is firewood stored?	

16. Do you find that fuelwood is scarce?

YES	NO

17. What other fuels do you use during fuelwood scarcity? Rank them in importance from 1 to 8. (1 is most important)

Type of fuel	**Place where you get it**	**Rank in importance**
Waste		
Paraffin		
Grass		
Peat		
Leaves/Twigs		
Dung		
Electricity		
Other		

18. Would you like to add anything regarding your family's use of wood?

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2.0 Cooking Habits by rural households

19. What do you use for cooking (stove)

Open wood fire		Mud stove		All metal stove	
Fired clay stove		Combination of metal and clay		Other	

If other specify

……

20. Is the stove used for one continuous longer period of cooking?

YES		NO	

21. What type of pot do you use for cooking?

Fired clay pot		Metal pot	

22. What size of pot is used?

Small		Medium		Large	

23. Type of fireplace where food is prepared.

Three-stone fire place		Fire place build in cooking area			

If other specify

24. Once food is cooked, what is done with the wood?

Extinguished		Continues to burn	

25. Is the heat of the fire monitored after cooking?	YES		NO

26. Are all ingredients and tools put together before the fire is started and cooking commences?	YES		NO

27. Is the lid of the pot tight fitting, and how often is it used?

Lid is **not** tightly fitted and used often		Lid is tightly fitted and used often		lid is tightly fitted and used occasionally	

Lid is not tightly fitted and used occasionally		Lid is rarely used			

28. Do you practice double cooking (i.e. where pots are stacked)?	YES		NO

29. How do you use water during cooking?

Fill pot with water and add food		Add water as need while cooking		Use as little water as possible	

30.. Do you use a haybasket (set into something that keeps food warm and where it can continue to cook when cooking?

YES		NO	

Food Preparation, duration and type of fuel used

30.	**Type of food**	**Type of fuel used**	**Duration of cooking in Hours**
	Samp		
	Pap		
	Meat		
	Bones		
	Vegetables		
	Bread		

31. If you use hard grains and beans, do you pre soak them prior to cooking?

Use hard grains but do not pre soak them		Use hard grains and beans and pre soak them	
Do not use hard grains and beans			

32. If you use hard grains and beans, do you mill or pound them prior to cooking?	YES		NO

33. Are foods cut up into small pieces prior to cooking?	YES		NO

34. Do you use food tenderizers?	YES		NO

Shared Cooking Practices

35. Is cooking equipment shared with other households?

Fireplaces are shared		Pots are shared	
Fire places and pots are shared		We do not share	

36. Is cooking shared with other households (multi family)?

YES		NO	

3.0 Perceptions of the community on community woodlots

37 Are the woodlots important to you?

YES		NO	

38. Do you make use of woodlots?

YES		NO	

39. What products do you collect in the woodlot?

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……

40. Would you prefer to see other trees other than gum, pine and wattle trees in the woodlot?

YES		NO	

41. What other trees can be planted in the woodlot?

……

……

42. Would you say that there is enough woodlots around your village to meet present village needs for fuelwood?

YES		NO		Don't know	

43. Would you say there is sufficient wood for future generations?

YES		NO		Don't know	

44. Prioritize the importance of woodlots in terms of the following: Ranking from 1 to 7

Fuelwood	
Timber	
Poles	
Thatching Grass	
Protection of the environment	
Food and fruit	
Fodder	

4.0 Perceptions and attitudes regarding afforestation and community tree planting

45. Do you make use of indigenous trees in the forest? (*This information is confidential and will not be used against you)*

YES		NO	

46. Which trees from the forest are used and for what purpose

Name	Purpose

47. Has anyone in the household ever planted trees?	YES		NO

48. If yes, who planted the trees?

Men		Women		Men & Women		Children	

49. Where were the trees planted?

Around the house		Village communal tree plot		As a field boundary around your own yard	
In own yard		Church tree project		On a special private plot	
School tree project		Forest Division project		Other	

If other specify

50. Where did you obtain the seedlings

Grew them ourselves		From the Forest Division	
From the church		From the school	
Other source			

51 Why do you plant trees?

Fuelwood		Commercial sales of timber	
Poles		Minor products (honey, ropes, etc)	
Food and fruit		Protection of the environment	
Fodder		Provision of shading	

If other specify

……

52. Where would you plant these trees?

Around the house		Village communal tree plot		As a field boundary around your own yard	

In own yard		Church tree project		On a special private plot	
School tree project		Forest Division project		Other	

If other specify

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…….

53. What are the main difficulties in planting your own tree based on experience in this village or other villages?

Lack of seedlings		Don't know how to grow trees		Cattle may graze on seedlings	
Not enough land		Other people may cut down trees		Too busy with other work	
Pests may be harboured in trees		Government may issue regulations on use of trees later		Other	

If other specify

……

……

54. Has government or your councils ever discussed a tree planting project as a communal venture?

YES		NO		Don't know	

55. For what reasons then, has the village decided not to start a tree planting project?

Don't know		We are planning to start one later	
Not enough land		People are unwilling to do necessary work	
There is no need for it		Too risky, chances of failure are high	
Can't get seedlings		Other	

56. Would you like to add anything regarding the indigenous forests, plantations and tree planting in your area?

……

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